# Episode 78: Breakthroughs and Boosters

**Chris Dall:** [00:00:00] Hi, everyone. Before we get started with this week's episode of the Osterholm update, I want to let you know that CIDRAP is commemorating its 20th anniversary this year. Since its inception in 2001, our team has created what is now a globally renowned center tackling the world's toughest challenges in infectious disease and public policy, including COVID-19, Ebola virus, Zika, antibiotic resistance, universal flu vaccines, and drug supply shortages. In celebration of this milestone anniversary and to ensure we're able to continue our important work into the future, Christy Walton has pledged a $4 million challenge to complete a $10 million fundraising campaign. A $1 match will be made for every $2 donated, helping to build a solid endowment to support CIDRAP's work. Please visit CIDRAP.edu/donate and thank you. And now to this week's episode of the Osterholm update. 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. Back in June and early July, when the U.S. was in the midst of a dramatic decline in COVID-19 cases and the delta wave had not yet begun, the return to a pandemic free holiday season seemed like a hopeful, but not unrealistic scenario. Families would once again be able to gather for holiday celebrations without fear of infection. That was the hope that the vaccines provided. Fast forward five months, and with the holidays now upon us, the picture is a bit murkier. The vaccines will allow many of us to have the type of Thanksgiving that we had in pre-COVID times. But with COVID-19 cases once again surging in many parts of the country and a significant proportion of Americans still unvaccinated, it is clear that we are not yet free of this pandemic. This week on the Osterholm update, we're going to take a deeper look at the dynamic situation here in the United States after we provide an update on the worsening situation in Europe. We'll also examine the growing calls to expand access to COVID-19 booster shots, discuss how people should be assessing the risks of Thanksgiving get togethers, answer a COVID query about how past pandemics have ended, and tell you about the latest Beautiful Place submission from one of our listeners. But first, we'll begin with Dr. Osterholm's opening comments and dedication.

**Michael Osterholm:** [00:02:50] Thanks, Chris, and welcome to all of you. Back to another episode of the podcast, each and every week I start out these podcasts with hopefully something smart or wise to say, and each week I find myself just continuing to apologize for how little I knew about what was happening. And that will be front and evident again this week in terms of just trying to understand what we might expect here in the United States over the course of the next several weeks to months. And of course, what's happening globally. But at the heart of all of it is the fact that we are learning. We're learning a lot. We continue to learn a lot. We continue to understand the power of the vaccines. Again, I will repeat this often. These are remarkable tools. They're not perfect, but they are remarkable. And how do we best use them? And as I leave you today, I will leave you with some positive notes about where we might be going and what we can do. And as we come into this holiday season, we do have a lot of control over our own safety with regard to COVID. And again, we'll emphasize that today. Today, I want to dedicate this podcast to a remarkable group of people who I so appreciate. I happen to have some of them in my own family. I'm dedicating this podcast to the parents, the guardians, the grandparents, whoever have been involved in helping the five to 11 year olds get vaccinated over the course of the past two weeks in this country. I've seen some amazing efforts, major clinics where literally more than a thousand children were moved through efficiently to get vaccinated, parents with smiles on their face, encouraging their their kids to get vaccinated. Kids who have come out of the vaccine programs with their little Band-Aid on with a big smile on their face. And so that is what it is all about taking this virus on and that positive and affirmative note. So to all you parents, all of you responsible for getting these five to 11 year olds vaccinated. Thank you. Thank you and congratulations.

**Chris Dall:** [00:04:58] Mike, we've talked a lot about Europe in the podcast in recent weeks, but it continues to be the world's major COVID-19 hotspot and no parts of the continent are untouched. So what's the latest on the situation in Europe and are there any other parts of the world that you're keeping an eye on?

**Michael Osterholm:** [00:05:14] Unfortunately, Chris, you're right on the Mark. We've been talking about the growing activity in Europe for a couple of months now, and in that time, the situation there has only gotten progressively worse. This isn't a surprise to the routine listeners of this podcast for what's been happening in Europe is not totally unexpected. Just this past week, Europe reported nearly 2.2 million cases, representing the highest case total for the region since the start of the pandemic. Let me repeat that. Just this past week, Europe reported nearly 2.2 million cases, representing the highest case total for the region since the start of the pandemic. This is now their seventh consecutive week of increasing cases. In fact, if you look at weekly cases in Europe in mid-September, just before the surge began, they stood at around 1.1 million. So they've basically doubled their case numbers over the past two months. Deaths in Europe have also risen for the ninth straight week, with last week's toll coming in at 28,500. Now, where does that stand worldwide? Well, total global cases in the past week fell just short of 3.4 million and around 50,000 deaths. This means last week, Europe accounted for nearly two out of every three of the world's cases, and it documented more than half of all the global death toll. Once again, most of these deaths are out of Eastern Europe, according to the Washington Post dashboard, as has been the case for well over a month now. Every single one of the world's top 12 countries with the highest death rates over the past week were in Eastern Europe. As we've noted previously, most of the countries on this list have yet to fully vaccinate even half of their population. The critical importance of vaccination. And gaps in protection are having a marked impact. An article published by Reuters on Tuesday stated that Bulgaria, which currently has the world's highest number of per capita deaths from COVID, reported 50% more deaths in September than would have been expected based on pre-pandemic levels. In other words, COVID itself has more than doubled the death rate in Bulgaria. In fact, Bulgaria had higher excess mortality than any other country in the EU. They also happen to have EU's lowest vaccination rate, with less than one in four residents vaccinated. Remember that 25% level when we talk about other countries in the world. In addition, excess mortality was notably high in several other eastern European countries, including Lithuania, Greece and Romania, which tallied at least 30% more deaths in September then they'd expect based on pre-pandemic records. This data is supported by stories describing overwhelmed morgues in Romania's capital and the canceling of elective procedures throughout all of Bulgaria just to cope with the surges in COVID patients. In Serbia's capital city of Belgrade, authorities from the city's graveyard have reported a recent average of 65 burials a day, well above the typical 35 a day prior to the pandemic. They're now working on Sundays to accommodate this surge. So I think it's clear that much of Eastern Europe has been experiencing its darkest days of the pandemic. However, as we've mentioned in previous episodes, many countries in Western Europe are also lighting up now, despite having markedly higher vaccination rates than their neighbors to the East and, for that matter, higher than we have here in the United States. A handful of these countries, including Austria, the Czech Republic, Belgium, Ireland and the Netherlands, have some of the world's highest number of cases per capita. In fact, Austria, the Netherlands and Germany have all hit new record high case rates that are only continuing to grow. Similar growth is occurring in places like Denmark and Norway. Even the United Kingdom, which has been dealing with its own surge from Delta since last May, is now reporting another rise in cases. Remember, many of these countries have vaccination rates that dwarf the U.S., where 59% of the population is fully vaccinated. Even Spain and Portugal, with vaccination rates of 80 and 87%, respectively, are now seeing case growth reported. Now, do I expect these Western European countries with 70 or 80% of the populations fully vaccinated to experience what we're seeing in Eastern Europe? No. In last week's episode, I covered the clear reduction in hospitalizations and deaths that result from having had such high vaccination rates. But as impressive as these rates are, especially to those of us living in the U.S., they're not a panacea for eluding challenges. For example, in the Netherlands, which has fully vaccinated 73% of its population, it is now reporting the highest number of cases since the start of the pandemic. In October, they had a total of around 300 patients hospitalized for COVID. Now, just a month and a half later, that number has climbed to nearly 1,700 patients hospitalized for COVID. Remember, it was 300 in October. Although it is still below the peak of 2,800 hospitalizations last winter, the surge is stretching the capacity of their health care systems. As a result, hospitals are delaying all elective procedures. In addition, the country has opted to reimpose a partial lockdown for the next three weeks, which includes limiting the hours that shops and restaurants can remain open. So are vaccines having an impact in the Netherlands? Well, according to a report by the country's health ministry published earlier this month, fully vaccinated residents were 17 times less likely to be hospitalized than residents who are unvaccinated. Of those who were hospitalized in the country, the median age of unvaccinated patients was 59 years, compared to a median age of 77 years for fully vaccinated patients. But again, the gaps in protection that are left even with nearly three out of four residents fully vaccinated are still clearly wide enough for this virus to get in and cause real problems. It appears that other countries in the region are coming to the same realization and are now trying to come up with different strategies to help limit the damage. On Monday, Austria announced a lockdown for the country's two million residents, who remain unvaccinated. Austria, which has fully vaccinated 65% of its population, is currently reporting its highest number of cases since the start of the pandemic. Germany, which also has had record high cases despite two out of every three residents being vaccinated, is also expected this weekend to tighten restrictions, particularly for those who have chosen to remain unvaccinated. So as frustrating as it is to hear, we're far from done with this. I know it's been a long and difficult time. Oh, do I know that. I know everyone's sick of this pandemic. Trust me, I'm sick of it. My family is sick of it. My colleagues are sick of it. But if this is happening in Europe, I think the rest of the world is equally, if not much more vulnerable. We're going to see more surges. If a big enough vaccine wall is built, the health care system can still function as intended, meaning they tend to bend but not break. Otherwise, low vaccination rates are a recipe for overwhelmed health care systems and record-setting deaths. If we think about what we could expect around the rest of the world, remember I've been talking about countries that have 65 to almost 80% of their population vaccinated, and they are still experiencing this terrible, terrible impact from COVID. Think about other countries around the world where we're seeing limited activity right now. But it isn't because of their vaccination rates. India with 30% vaccinated, not 70. South Africa with 23% vaccination rates. Peru 51%, Paraguay 36%. Even countries that we think of in terms of better control programs for COVID. Thailand, only 53% of the residents are vaccinated. Vietnam 37% vaccination rates. The Philippines 36%, Indonesia 31%. If you look at these countries even accounting for previous infections and the number of people that may be protected from that natural immunity, we still have a tremendous, tremendous, tremendous amount of human wood out there in so many of these countries for this coronavirus forest fire to burn. So as much as the rest of the world seems quiet right now, do not take that as a victory. Take that as an unexplained opportunity to get more people vaccinated because we don't know why we're not seeing increased number of cases there. But as I have said, time and time again, we will. We will see these other countries experiencing the kinds of surges that we're seeing in Europe. If there was ever a wake up call, it should be our experience in Europe. With vaccination levels as high as they are and still seeing the challenges that are occurring there. We have to understand that so much of the world remains vulnerable and it will light up eventually.

**Chris Dall:** [00:14:59] Here in the United States, cases have once again started to rise nationally after two months of decline. In our own backyard, Minnesota and the Upper Midwest appears to be the nation's emerging hotspot. But Mike, you said in our podcast prep meeting this week that you feel like the situation in the U.S. is more uncertain than it's ever been. How so?

**Michael Osterholm:** [00:15:19] Oh, Chris, this is a tough time. And let me just reaffirm a disclosure I've made in numerous occasions of the past, but it really deserves repeating today. I think I know less about what is happening with this virus today than I might have expected to know six months ago. The uncertainty I feel about where we're going in this country with this virus really stems from a variety of different things that I see happening, all about the world of observation, trying to understand patterns, trying to understand what has the past two years taught us. On the one hand, you can look at the overall national numbers, which, as you mentioned, have been trending back up. But remember, the national metrics are really just a collection of what's happening at the regional, state and local levels. And when you start focusing in on what's been occurring in these different pockets of the country, it's hard to know what the future holds. There are a lot of moving parts, but I'll do my best to provide some sense of what I am seeing and how I interpret what I'm seeing with regard to our future. So let me start with where the U.S. is as a whole. The two months of declining activity we saw after Delta's peak in mid-September, which took us from around 170,000 cases a day to 70,000 cases a day, are now in our rearview mirror. Even the plateau, where daily cases range from 70,000 to 75,000, was fairly short lived, lasting just over a week. Now we're seeing this really abrupt U-turn, with daily cases up to nearly 86,000 cases a day, which is 18% higher than it was two weeks ago. Hospitalizations, which sit at around 47,000, have also started creeping back up over the past few days. As a result, we'll likely see daily deaths start to follow suit. Not the greatest news for a country that is still reported an average of 1,100 deaths a day from this virus. So what's driving this? Well, that's where the patchwork of activity comes into play. As of Tuesday, a total of 33 states reported growing cases over the past two weeks. Fourteen of those states saw cases increased by 40% or more. This is as dynamic a change and increase in cases that we've seen throughout almost all the pandemic. This includes places like Minnesota, right where I'm at, where cases have risen by 84% over the past two weeks. Michigan, which has reported a 68% increase. Illinois, which is up 58%. Wisconsin a 52% increase. Indiana a 52% increase. And Nebraska a 29% increase. In each of these Midwestern states, the current case rates sit above the national average of 26 cases per 100,000. In fact, per capita cases in Michigan, Minnesota, North Dakota and Wisconsin are more than double the national average. Then there's the Four Corners area of the country, where activity has continued to remain high. Colorado has reported a dip over the past few days, but cases in the state are still at the highest level since the surge last winter. Meanwhile, Arizona and Utah, which are also experiencing their most activity since last winter, continue to report gradual case increases and finally you have New Mexico, where per capita cases are more than double the national average, which still saw cases grow by 45% over the past two weeks. And then, in the northeastern region of the country, states like New Hampshire and Vermont have seen cases explode in recent weeks, with per capita cases now more than twice the national average. New Hampshire has reported an increase of 123% in the past two weeks, and Vermont is up 73%. And remember, these are two of the most vaccinated states in the country. Other states in the Northeast, including Maine, Rhode Island, Delaware, New York, Massachusetts and New Jersey are all also beginning to light up. Finally, although many states in the South are still seeing some of the lowest activity after going through their own devastating delta wave, there are early signs of possible upticks in places like Arkansas, Missouri and Tennessee. I also want to note, as I have in previous podcasts, this pandemic is taking a toll on our kids. More than 122,000 children were diagnosed with COVID the weeks of November 4th to the 11th. The American Academy of Pediatrics noted, this is the 14th consecutive week of more than 100,000 pediatric cases. As of this past week, they continue to account for almost 27% of all cases in the country. We know that schools have been severely impacted by the ongoing efforts with COVID. I know that I've thrown a lot at you, and if it's confusing in terms of what's happening in this country, I apologize. But I also want to welcome you to the club. If you want the CliffsNotes version, this virus is hitting most of the Upper Midwest, the Four Corners area, and some states in the Northeast particularly hard right now. It's unclear what the ceiling will look like for activity in these areas, some of which are experiencing major challenges to their health care system. In a number of other places, it's smoldering at elevated levels, and I'm not exactly sure what path it will take forward in the coming weeks. I also want to emphasize the fact that what we're seeing here really reflects several different patterns of the spread of the virus in our communities. If you look at the Upper Midwest, we are following closely what we've seen in the UK, where after an initial surge with the Delta virus and peak levels of cases, the numbers start to come down somewhat quickly, but they only come down to a very limited amount. They level off and then they go back up again. And these particular surges are sometimes lasting, as we're seeing now in the U.K. months, not weeks. And this is what we're seeing in the Upper Midwest right now. On the other hand, you have the model like we see in the southern United States, where we saw these very rapid increases in cases with surges that obviously were devastating to communities. But then the case numbers actually dropping precipitously after several weeks at that high level and going back to baselines that are almost those of what we saw before the surges. This has surely played out in places like India and even in parts of Eastern Europe. So what does this mean? Why do we see this prolonged activity in some areas and other areas the surges up and down? Well, let me just re-emphasize the point I make week after week. No one no one knows why these surges begin or why they end. And anybody that tells you they do, they probably have a bridge to sell you. We know that what our human activity can do, mitigation in terms of distancing, and of course, vaccination can have a big impact on how big that surge is, how many cases, how many deaths. That is an important aspect, but we don't understand why these surges occur. I hear people saying, well, it's seasonal. Look at, you know, the Upper Midwest and the Northeast are getting hit right now. Well, just remember that the surge that we saw initially with Delta in this country occurred in the southern states literally during the hottest days of the summer. And we've had an incredibly mild fall, record setting mild fall in much of the Upper Midwest, where that did not precipitate a cold weather response that some people are ascribing to what might be explaining the current situation, just simply not the case. And then look at the Four Corners area. Yesterday, the temperature in Denver was 68. The temperature in Albuquerque was 72. The temperature in Phoenix was almost 80. You know, those are not fall like conditions that one would normally think of with influenza or COVID-19. So we can't attribute it to seasonality as much as many people want to do that. And before I go on and summarize where I think we're at, I'd like to wade into the controversy that has arisen in the state of Florida about the governor taking credit for the low level of cases that have been seen and somehow his intervention efforts was the right thing to do. Well, you know, basically even a broken clock is right twice a day. And I think that it's really important to understand when is this cause and effect and when not. And so when you have a situation with a big peak where it goes up and comes down, you know you never want to be on the left side of that curve because when it goes up, if you're doing something, you're the cause of why it's going up. On the other hand, you always want to be on the right side of that curve because if it is going down. You surely can take credit for it, even if you had nothing to do with it. I think one way to look at the Florida situation and to test that conclusion that the governor's approach was so highly successful, I've tried to look at two areas Florida and Singapore, Singapore having to me one of the most impressive and comprehensive response programs of anywhere in the world. And in fact, their vaccination programs have demonstrated how important they can be in reducing cases. If you look at Florida, the seven day average for cases peaked at 21,723 on August 17th, and deaths peaked at 393 on September 2nd. Let me repeat that, 21,723 cases the peak on August 17th. Deaths peaked at 393 on September 2nd. On September 2nd, a total of 53.4% of the residents were fully vaccinated. The Florida population is 21,477,000. If you look at Singapore, the seven day average for cases peaked at 3,777 on October 29th, and deaths peaked at 14 a few days in late October and early November. On October 26th, a total of 82.7% of the residents were fully vaccinated. Their population is 5.9 million. So after adjusting for population size between Florida and Singapore, I found the following: If Florida's peak was equivalent to the rate seen in Singapore, they would have reported a peak of 13,715 cases a day, 63% of their actual peak. Deaths would have peaked at 50 a day, only 13% of their actual peak. The point being is is that Singapore was a model. And when you adjust for the population size and look at what could have been expected in Florida, you can see how devastating that surge actually was. Again, the peak in Florida could have been 63% of its actual peak if they had carried through programs like Singapore. And the deaths, more importantly, would have only been 13% of their actual peak if they had had a comprehensive vaccination and response program. So let me just summarize this by saying that Florida was not a model of success. Florida's case numbers are low right now because the virus is doing what it's doing. It had nothing to do with the governor's programs, and despite their assertion that they had such a important impact on this pandemic episode in Florida. When you compare it to a place that really did have an effective response like Singapore, you can see absolutely how they failed to prevent many of the deaths that occurred with this COVID pandemic. Needless to say, it is an ominous position to be in as the Thanksgiving holiday and all the travel that comes with it approaches. And if that's not enough, I'm also keeping my eye on influenza activity in this country. This is a disease that I have spent the past 45 years of my career working on. Although it's still a bit too early to determine just what flu will look like this year, we're seeing some hints of it popping up and making its presence known. Just this past week, it was reported that the University of Michigan confirmed more than 500 cases of H3N2 influenza on its Ann Arbor campus, and this has occurred since early October. More than 300 of the cases were diagnosed during the week of November 8th alone, prompting an intensified investigation to help determine what exactly is going on. In addition, the CDC is reporting the patients visiting health care providers with influenza like illness was high in the state of New Mexico earlier this month. So again, although I think it's too early to know what this flu season will bring us, we shouldn't simply expect it to play out as it did last year. Please get your flu shot. If you look at just what's happening in Minnesota right now, we have seen a substantial decrease in influenza vaccine uptake from previous years. Across all age groups, except those 65 years of age and older, influenza vaccine administration is down substantially this particular fall winter season compared to previous years. So I would urge you as another element of protecting your health not only against COVID, but also against the possibility that we may see a flu year this year. Please get your flu shot. So in conclusion, get your flu shot. Get your COVID vaccine, whether it be your primary series, which is also important or your booster. And stay tuned. We truly are entering some very, very uncharted territories.

**Chris Dall:** [00:29:21] So, Mike, rising COVID-19 cases and concerns about waning vaccine immunity have led governors in several states to issue executive orders that allow all adults six months out from the second dose to receive a booster shot. And by the end of the week, it appears likely that both the FDA and the CDC will sign off on a nationwide expansion of booster doses of the Pfizer vaccine. So what I'm wondering about is does the data on waning immunity and breakthrough infections support expanding access to boosters?

**Michael Osterholm:** [00:29:50] Well, first of all, let me just confirm a point you just made. Later today, the FDA will in fact issue an approval for the use of the Pfizer vaccine as a booster dose for all adults. I'm still waiting to get clarification on will it be 16 years of age and older or 18 years of age and older. But bottom line message is at six months, everyone can get a booster dose with Pfizer. Now, if you in fact had Moderna or you had J&J, remember you can use the Pfizer vaccine for that booster. And we expect that the Moderna vaccine will be approved in the near future for booster doses also. So if you had Moderna originally, you can still stay with Moderna. So I think this is going to be an important announcement by the FDA. I expect tomorrow that the CDC's Advisory Committee on Immunization Practices will meet and will basically confirm the recommendation that all individuals get a booster. Now we continue to see some debate about whether these boosters are needed or not. And as I pointed out repeatedly on these podcasts, we can't wait until a year from now to come up with confirmatory evidence that in fact, boosters are important or not relative to serious illness. I think the data already are clearly giving us a very strong signal that once you get six to eight months out, which remember, we've only now approached that time period from vaccinations that occurred earlier this year to know what's happening six to eight months after your initial series. That in fact waning immunity is important not just in the actual occurrence of infections, but also potential serious and life threatening infections. So when we look today at the data that is most often cited, which is the one first recognized in Israel in July, we also now have at least 10 reports that show that the waning immunity occurs with all vaccines and that protection is really fully restored by this third booster dose for the mRNA vaccines and the second dose for the J&J vaccine. So I believe the data are clear and compelling that waning immunity is important. Now what is the challenge, of course, is is this about serious illness or is this considered a luxury dose, one where we can afford to avoid minor illnesses? And I think that the data are really compelling there too, that as we get further and further out, the effectiveness against hospitalizations and deaths also begins to wane. And so that therefore these boosters are not only important in preventing milder breakthrough infections, but also over time more and more serious, life threatening infections. And I wish I had all the data right now that might be available to us two years from now, but I don't, nor does anyone else. And so we have to make the call now. Do we want to wait to find out for certain that these are just milder infections? Or do we want to actually take action to avert potential serious, life threatening infections? You know where I'm going to be. I'm going to act on getting the booster doses to everyone, just as many of the countries around the world are now doing. The big question I have, which I think still is front and center, is what will come next? Will these booster doses we're getting actually protect us for some extended period of time or will in six to eight months we see waning immunity again? There is some initial data just looking at antibody levels in people who have had a booster dose, suggesting that the third dose may be effective for at least nine to 10 months, which I would be the first to tell you, let me just say that I'm not sure that's an extrapolation that I have all that much confidence in. But it does raise the issue that if we even have protection at nine or 10 months, that still signals the need, potentially for boosters down the road. I don't for one moment believe we're going to be able to provide the world with booster doses every six to eight months and expect that that's going to become a routine public health program. So there's still unanswered questions. I come back to a point I make time and time again. These vaccines are remarkable, but they're not perfect. And this is one of the areas where remarkable means that you can restore protection back to those earliest days after the original series of vaccine. And that's great news. The question is, will we see the level of protection drop over time? This is what I continue to call evolving science. We will study. We will work to understand what we're learning. We will implement the lessons learned. We will continue to study. We will learn. We will continue to implement the lessons learned. And so this isn't like what happens after you get your second measles vaccine dose where you can say, you know, I'm pretty well protected for life now. We're in a different ballgame here. Is this going to be more like flu vaccine or maybe an annual immunization or even more frequently required immunizations are are on the table? I don't know. But for now, I know getting vaccinated first and second doses or first dose relative to J&J and then getting that necessary booster dose is really important in addressing the immediate risk that we have right now.

**Chris Dall:** [00:35:40] So I think some context on breakthrough infections would be helpful here for our listeners. Well, it seems clear at this point that we are seeing increasing numbers of breakthrough infections and we're seeing breakthrough infections increase as a proportion of overall infections. Mike, isn't that to be expected as more people get vaccinated?

**Michael Osterholm:** [00:36:00] Chris, let me address this from two different perspectives. First of all, let me just share with the our podcast audience where we're at in administering booster doses here in the United States. As of this past Tuesday, 30 million booster doses have been administered in the U.S.. The CDC's vaccination rate data reflects the recent spike in daily doses administered and could be largely attributed to just booster doses. Again, I want to remind everyone we still need to get those first and second doses in our loved ones, our friends, our colleagues. On October 29th, the seven day moving average of daily number of doses administered was the highest it's been since May 28th, at nearly 1.3 million doses administered per day. Over 820,000 of those doses or 65% were booster doses. Despite this promising number, as of Tuesday, only 30 million booster doses have been administered, as I said earlier. That means that only 15.4% of fully vaccinated Americans have received a booster dose. Even in the 65 plus age group, only 36% of those fully vaccinated have received a booster dose. This is especially concerning for this age group, as we know that a vast majority of this group is eligible for a booster dose, with the only exceptions being those who received their mRNA vaccines less than six months ago or the Johnson and Johnson vaccine less than two months ago. Only about 16% of this group was vaccinated in the last six months, meaning that at least 84 to 85% of 65 year olds are currently eligible for the booster based on age alone. And as I pointed out, remember, only 36% have received it so far. So if we want to avoid more and more breakthrough infections and potentially life threatening and very serious infections, now's the time to get that age group boosted as quickly as we can. What do we know about breakthrough infections? Well, they are still relatively rare, but growing in number. The proportion of breakthrough infections as a percentage of all infections will rise as more people get vaccinated. I discussed this concept in terms of the epidemiologic phenomena of the more people get vaccinated, the higher the percentage will be of those who are infected will be breakthroughs. I addressed this in episode 63 back in August. Let me just, for example, take two theoretical populations both one million people, both the same age distribution, both having the same underlying health conditions and all of the factors that are associated with the risk of infection and severe disease. Just for the sake of it, I'll say that there's a 2% chance of developing COVID. Vaccine has an 80% of efficacy against infection and an additional 70% efficacy against hospitalization. So I've applied that now to both populations. But for the one population of, I have 90% of the population fully vaccinated, meaning 100,000 unvaccinated and 900,000 vaccinated. I would expect to see breakthrough infections making up 64% of all the cases, 64%. Now, if I have a population, only 50% fully vaccinated, so everything else is equal. 500,000 vaccinated. 500,000 unvaccinated. In this scenario, if I look at that, the breakthrough infections make up only 17% of the cases. So it's not about the fact that suddenly there's an epidemic of breakthroughs. The percentage of breakthrough infections we see in our communities will be directly related to what the percentage of people who are vaccinated. And I think this is an important point because as we see more people getting vaccinated, we should expect to see more breakthrough infections and particularly with time. So there is no new epidemic occurring of breakthroughs per say, other than the fact that we are seeing more people getting at six to seven or eight months who are not getting their booster dose. So this should dispel any myth out there that somehow the vaccines are starting to fail at a faster and faster rate and that basically somehow the vaccines are not working. If we just want to look at the number of breakthroughs in any one given area, it gives you a sense of what I'm talking about. Let's just take Minnesota, of course, my favorite state with one of the very best, if not the best health department in the country. They are reporting 3.2 million Minnesotans are fully vaccinated against COVID-19. Let me repeat that, 3.2 million. Minnesota has had 72,628 documented breakthrough cases. 10% of these breakthroughs have occurred in the past week. Of course, we're seeing so much more virus activity right now in Minnesota. 3,177 breakthrough hospitalizations have occurred and 519 breakthrough deaths. Let me put this into perspective. This means that about 2.25% of fully vaccinated Minnesotans have had a breakthrough infection. About 0.09 have had a breakthrough hospitalization and only 0.02% have had a breakthrough death. So this is still really a very rare event among this group. And if you look at the protection from the vaccines, you still have this 11 to 16 fold reduced risk of becoming infected if in fact you're vaccinated and you have at least a 20 fold decreased risk of dying if you're vaccinated. So I think it's really important to emphasize that breakthrough is a reality. One, we can deal with them by additional booster doses, how long we can deal with it is something we're still going to have to learn. And number two is don't be surprised when you hear these numbers. If I heard someone say 519 breakthrough deaths in Minnesota, my first reaction is, Oh my, this isn't working. Well, again, many of these deaths are those 75 years of age and older. They are individuals who have not received boosters, and these are the same people that unfortunately, just like with influenza vaccine, are at the highest risk of having breakthrough infections with whatever vaccine they get. So I think the perspective is this week is that booster doses are really important. Please get your booster dose. Number two, that it doesn't mean that the vaccine is suddenly a major failure, quite to the opposite, just with the numbers I cited for you. And number three, stay tuned. We'll continue to keep you posted on what we're learning about breakthroughs and what that might mean six or eight months from now. But for now, with your booster dose, you can reestablish that very high level of protection that was first seen after your initial vaccine series.

**Chris Dall:** [00:43:06] We answered a COVID query last week from a listener who had some concerns about attending a large Thanksgiving family gathering. But because this is on everyone's mind right now and our listeners want to know what Dr. Osterholm would do, I think we should revisit this discussion. Mike, are there any rules of thumb you have for our listeners to help them as they prepare for and think about Thanksgiving get togethers?

**Michael Osterholm:** [00:43:28] My single most important rule of thumb, is you are in charge of your own safety. And everyone has to feel empowered who are hearing these words to make your own decisions about, am I comfortable with the risk that I may put myself in getting infected with this virus in a family or other kind of social setting on Thanksgiving or, for that matter, any time? Secondarily, my next rule of thumb is what social and personal responsibility do I have to protect others from me in terms of my status relative to my own efforts to prevent myself from getting infected? And what this really means is as tough, as this might be to say, No, I won't attend. No, you're not invited. I know that this is a time where we all want to begin more healing. We want to have more social contact. We miss family members. But you don't want to have a wonderful moment on Thanksgiving and have to attend a funeral two weeks later. I can't emphasize that enough. So what are the rules about the things I should consider to one empower myself to be protected? Well, in this past week, Dr. Leana Wen, a colleague who is also a contributing columnist to The Washington Post, actually wrote a wonderful piece, "How to Assess the COVID-19 Risk from Holiday Gatherings." And she summarized the four things you need to consider the very same things I emphasized last week in the podcast, but let me use a colleague's words to help reinforce that. The first one is vaccination status of attendees. What's really different about this year's holiday get togethers is that we have the vaccines, and if you are someone who has been fully vaccinated and have had your booster, then you can assume a quite high level of protection, not just from you becoming infected, but from you transmitting unknowingly to someone else. So one, do not at all feel uncomfortable about demanding full vaccination among those who attend whatever event you're at. Now the challenge is for those kids who are just newly eligible to get their shots, the five to 11 year olds, you know they're going to be in kind of limbo land because most of them will have only had one dose. That surely is going to be helpful. And then of course, you have the children four years of age and younger. I don't have a magical answer for that other than to say if you want to be completely comfortable and it will come up in a moment talking about one of the other things to consider is you can do testing on the morning of Thanksgiving. Have one of the lateral flow rapid tests, test your kids. If they haven't been vaccinated because they couldn't be, test them. If they're negative, I would feel very confident and comfortable having that event that day. If you also consider community transmission, you'll recognize that there are many parts of the country right now that are hot, hot and hot. I would say that that should factor in in terms of how you look at who you would get together with, particularly if they such as kids are not vaccinated. Right now, we're seeing a tremendous amount of activity in the Upper Midwest in kids. So in this case, I would say, you know, they can't have been fully vaccinated. Then testing in the morning would be a great way to support the likelihood that they're not infected. Now, ironically, if you look at community transmission in some parts of the country right now, if you're in rural Louisiana, you may be in some of the safest communities in the country right now because we're seeing such limited activity there. You know, that would factor into me and say, basically, you know, maybe I don't need to test the kids there where we're seeing such low activity. The fourth thing that Leana mentioned was the issue of medical risk, and I've talked about that time and time again, both for yourself and for others. If you are someone who has an increased risk of having a serious illness, even if be a breakthrough infection, then do you want to attend such an event if others are going to be there, who might be unvaccinated? Or if you yourself are unvaccinated do you want to put others at risk? I can't tell you how many stories I know of where family members have come home for some event only to infect mom or dad or grandpa and grandma and a serious illness subsequently occurs. And unfortunately, sometimes deaths. So if I'm someone who has an increased risk of having a serious illness, high body mass index, much older age, the issue of underlying immune compromising conditions, solid organ transplant recipients, stem cell recipients, people who who even with vaccination may only have 50% protection against severe disease. So think about who you want to put together from a standpoint of medical risk. And then finally, what's the setting? This has been a topic we've talked about many times. For those parts of the country where you can have outdoor activities, those are going to be safer than if you're indoors, all crowded around a Thanksgiving Day table. Now, that's not going to be something that many locations can do today in the country because of the weather. But surely if you can in fact have an outdoor activity that's going to remain one of the safest options that you can have. So in conclusion, let me just say the important point here is feel empowered. Don't be goaded into attending someplace that makes you very nervous. First of all, what kind of time are you going to have if you're feeling at risk while you're there? It's going to be challenging. Again, if you just stick with these basic principles, you're going to do a lot to protect yourself and hopefully experience a wonderful, wonderful holiday season. You know, I missed this so much. I missed this so much the get together family and friends. And one of the greatest gifts I found throughout this pandemic is when, like people can get together, people who are fully vaccinated with their boosters, people who have made real efforts to limit their risk in the community of getting infected, getting together with that group and just one simple hug is priceless. I don't want anybody to miss that opportunity and you can if you follow these simple points.

**Chris Dall:** [00:50:43] So now to this week's COVID query, this one is from Yvonne, who wrote, "Can you say anything about the length of the COVID-19 pandemic?" In human history, other pandemics have somehow ended even long before the invention of vaccines. We are expecting this pandemic to last 12 to 18 months, but we are already past that milestone. It doesn't seem like this pandemic will end any time soon. What made previous pandemics end?" And Mike, this is kind of the $64 million question. But do previous pandemics give us any insight into this?

**Michael Osterholm:** [00:51:15] First of all, we have to define a pandemic because this is a term that gets thrown around a lot, but is actually poorly understood. A pandemic is a worldwide epidemic that occurs of any infectious agent, and they can be caused by different kinds of infectious agents in terms of how they're transmitted, it makes a big difference. Does it end or not? It also happens to matter whether it's an infectious agent that is causing a chronic infection. So, for example, HIV was in fact, a classic pandemic virus when it emerged in the late 1970s and early 1980s around the world. It's still here, still a problem. But we've been able to bring it under much better control right now because of the medications that have not only helped save lives but has reduced transmission in many parts of the world. So it's no longer considered a pandemic because in fact, now it's expected. We expect to see this. So it still an epidemic in many locations, particularly in low and middle income countries and prisons in a number of places like that. But that's one kind of pandemic. What I think the question really is getting at are those which are caused by respiratory transmitted pathogens. The idea that it's all of us at risk if you're in the same room with someone. That was never the case with HIV/AIDS, and there the only role model that we've had for a respiratory pathogen like this has really been influenza. And as some of you know, I have spent my whole career studying pandemics and trying to understand them and looking at the 11 influenza pandemics that have occurred in the last 250 years. And since the occurrence of COVID-19, some of us have gone back and looked carefully at those old pandemics to say, Hmm, did we miss something here? Was this really more like a coronavirus as opposed to an influenza pandemic? And I feel quite confident that the 11 pandemics that I'm talking about in the last 250 years were all influenza pandemics. This seems to be a new kind of pandemic of the coronavirus. That's where it gets complicated. We know that the new pandemic influenza virus eventually becomes part of the seasonal flu picture and that over time you don't see these big spikes in cases that you've seen with previous influenza pandemics and causing very high morbidity and mortality, like with some of the viruses like 1918. That doesn't happen because of anything we did as humans. That happens because that's what the virus does. Why does it show up? Why does it spread? Why does it become part of seasonal flu? We don't know. So the only experience we really have with a pandemic is influenza from a respiratory virus standpoint. So I don't know what this coronavirus is going to do. One of the reasons why is, do we have durable immunity? Is this something we can get infected with over and over and over again? If we do get infected over and over again, does in fact the illness become milder with each situation, which means that over the course of several decades, this would become, generally speaking, a much milder illness that might very well even become a seasonal virus infection? We don't know. So the question, I think really if you had to boil it down to its kind of might say root analysis is the fact that when will we be able to get our lives back, when can we, as a society start to operate, even if it's not exactly the same as before, but kind of like before? And that I can't tell you, I can tell you right now that there are many people in our society that are acting like that. They're done with the pandemic. As you heard me say, time and time again, unfortunately, the virus is not done with them. And that's what we're seeing happen, right this very moment here in the United States, here in Europe. It'll continue to happen around the world. The second thing is we don't know what's going to happen with the variants. With influenza virus each year, we can surely see changes in the seasonal viruses that confront us. So if you just take, for example, H1N1 that emerged in the 2009 influenza pandemic, it's still here. But it's a different virus in the sense that it's changed year after year after year, but not so much as to cause really a loss of protection by many against that virus if you've previously been infected. With COVID, we don't understand that. We don't know. So will SARS-CoV-2 have variants that suddenly can challenge the immune protection that either vaccine or natural infectious disease immunity results in? We don't know. So my bottom line message is the way we're going to get through this pandemic and come to what I might call an end is only going to happen when we have an endgame in place to say this today is what we will accept for COVID-19 in our communities. Is going to be like flu? Maybe we'll accept 30,000 to 50,000 deaths a year, as we do with influenza. We don't shut down communities. We don't require schools to close. We don't make people mask. Maybe we should in terms of highly effective masking, but we don't do any of those things. And the question is, is that when we'll know that the pandemic for COVID is over, when we get to that point? The second consideration with that, however, is what's going to happen globally. What will happen if we continue to see widespread transmission in low and middle income countries and variants keep spinning out? The pandemic is not done then, because that variant that is somewhere emerging in the low and middle income country could very well be the challenge to our vaccine integrity and vaccine protection in a high income country. So can we call the pandemic over until the whole world is over it? And we don't really have answers to that. So at this point, I would just say that in the next week to two weeks, I will be a coauthor on a paper that will be published that is all about what is our endgame. What are we considering to be those points of accomplishment that will tell us we have moved beyond the pandemic? And I will share that with this audience when it becomes available. And I can tell you that I think that it's a piece that will provide at least some framework for answering the question, When will the pandemic be over? So just stay tuned. We will continue to discuss this. I wish I had a better answer. I don't. I'm sorry. I'm very sorry. This is the trillion dollar question we're all asking. And right now, we only have dollars and cents answers.

**Chris Dall:** [00:58:31] So Mike, on a lighter note, where is our latest beautiful place submission from?

**Michael Osterholm:** [00:58:36] Well, in keeping with the international theme that we've been talking about today and the fact that we are so honored that we have people listening to this podcast around the world, I'm happy to report that this beautiful place actually comes from Taiwan. It comes from Mike, he wrote. "I wanted to say a big thanks for you and all the work you do. I live in Taiwan, which was possibly the only other country pursuing a zero COVID goal, though without the draconian measures. There was an outbreak in May and despite my pessimism, it was rustled under control, thanks in part to an aggressive contact tracing and isolation, universal masking, but above all, a strong sense of responsibility to follow the rules. Nonetheless, I haven't forgotten for one moment how pernicious this virus is and how the situation can change so quickly. Having lived in several countries in Asia and also the U.S. during the pandemic, I could write pages about what I've observed. But this email is about my beautiful place, which is Lugu, Nantou, Taiwan. It's a view from a tea garden in the mountains. It's a difficult drive, on narrow, winding roads. But the view is rewarding, and the cool mountain air has a fresh smell of tea leaves. When I'm here, I sit with a cup of tea or walk through the gardens and realize that the bubble of normalcy may at any time burst. But also, I am filled with hope as how powerful the results can be when people put aside ideology and politics and adopt a we're in this together attitude and come together for the greater good of their fellow citizens and community. Regards, Mike." Well, I want to thank Mike for the beautiful picture of the gardens in Nantou. So, Mike, thank you so much for sharing this very beautiful place. The picture brings a great sense of peace, and your description of that place only reinforces that. So thank you. And we continue to hope that Taiwan can provide that international leadership of how to minimize the impact of this horrible virus.

**Chris Dall:** [01:00:50] And I just want to remind listeners that if you found a special place of comfort or solace during this pandemic and want to share it with us, please email us at osterholmupdate@umn.edu. We love hearing about and seeing the places that have helped get you through this difficult time. And one additional note for our listeners, next week because of the holiday, we will record a shorter episode of the Osterholm update, mostly focused on the situation here in the United States. And we will post it on Wednesday, the 24th of November, so stay tuned for that next week. And Mike, what are your take home messages and closing thoughts for today?

**Michael Osterholm:** [01:01:24] Well, Chris, let me begin by just adding my every week comment about all the numbers I talked about today. That it is so easy to get caught into the numbers and forgetting what each of those numbers represent. So I know this is something you hear week after week after week, but to me it's almost something that is a requirement of being able to deliver this podcast is to never forget the faces and the names, the places of our moms and dads and our uncles and aunts and our grandpa and grandmas and our brothers and our sisters and our children, and all those who have suffered so miserably from this pandemic. They were not numbers, never once. In terms of the major themes of today's podcast. First and foremost has to be the pandemic is just in its next act. It is not done. And that's hard for people to hear, that's hard for people to understand because they said, Wait a minute, two years is enough time. I'm done. Never forget we're on virus time. We're not on our time and what we can do to try to minimize the impact of that virus surely still does rest in our own hands. Vaccination, vaccination, vaccination, not putting yourself in a risky position to get infected. But we're in this for the long haul. We'll be here with you for that long haul. We will attempt to give you the best perspective we can on where the future is going to take us. But the bottom line is you can't give up yet. Number two, first doses of vaccine. If you have not yet been vaccinated, it is not too late. Please get vaccinated. If you've previously been infected, get at least one dose of vaccine because the data now are clear and compelling that can greatly enhance your protection. Get a booster. If you're eligible for a booster right now, please do that. Don't be someone who has made every effort to fully get vaccinated and then let the booster go by the wayside, only to then have a breakthrough infection and potentially one of those fatal breakthrough infections. Get vaccinated. And finally get your flu shot. Now is the time. Don't wait, please don't wait. If flu does pick up, it could pick up quickly in our communities. Not sure it's going to, but it might. And so now is the time to get your flu shot. The third point, kids are still a critical part of this pandemic. I can't emphasize enough how much damage this virus is doing to our kids, their families, the social settings, the learning experiences. Please never forget that. Therefore, please get your children vaccinated. If they are five years of age and older, you could provide them with a life saving action that you'll regret later if you don't, and something adverse happens to them. Please get them vaccinated. And finally, in the holiday season, feel empowered. As hard as it is, as much as you may feel like the outsider. You know, some people will look at you as an alarmist, an extremist, don't put your health at risk. You know, feel empowered and whatever your circumstances are, where we are in the vaccination spectrum, the people you get together with and where they are at feel empowered. We want you around next year and the year after. By that time, as I said, we'll be doing a podcast about the price eggs or something, I don't know, but not COVID I hope, but we want you to be with us. So that really to me, remains a very, very important point of this entire podcast. So today for my closing, I could very well have come up with something about stay the course or, you know, any of these things that are trying to get people to rally around this next and latest challenge that we have. But you know what? We deserve to have a moment of some levity. And yet, at the same time, some sense of future and vision and probably one of my most favorite songs in the entire world was sung by a frog. In episode 35 last year, the title "The Last Mile to the Last Inch," ironically, what a title now, it was posted on December 10th of last year, the Rainbow Connection. "Rainbow Connection" is a song from the 1979 film The Muppet Movie, with music and lyrics written by Paul Williams and Kenneth Ascher. The song was performed by Jim Henson as Kermit the Frog in the film. "Rainbow Connection" reached number 25 on the Billboard Top 100 in November of 1979. With the song remaining in the top 40 for seven weeks total. Williams and Asher received an Academy Award nomination for the Best Original Song at the 52nd Academy Awards. In 2021, "Rainbow connection" was deemed culturally, historically or esthetically significant by the Library of Congress and selected for preservation in the National Recording Registry. Probably the real test of just how significant the song is is that it has been rerecorded by 32 different artists, including the likes of Barbra Streisand, Willie Nelson, Judy Collins and Kenny Loggins. That's staying power. So here it is a song about vision, a song about believing, a song about who we are in this pandemic. "Why are there so many songs about rainbows and what's on the other side? Rainbows are visions, but only illusions and rainbows have nothing to hide. So we've been told and some chose to believe it. I know they're wrong. Wait and see. Someday we'll find it the rainbow connection the lovers, the dreamers, and me. Who said that every wish would be heard and answered when wished on the morning star? Somebody thought of that and somebody believed it. Look what it's done so far. What's so amazing that keeps us star gazing and what do we think we might see? Someday we'll find it the rainbow connection, the lovers, the Dreamers and me. All of us under its spell, we know that it's probably magic. Have you been half asleep? Have you heard voices? I've heard them calling my name. Is this the sweet sound, that calls the young sailors, the voice might be one in the same. I've heard it too many times to ignore. It is something that I'm supposed to be. Someday we'll find it the rainbow connection. The lovers, the dreamers and me." At the end of this pandemic, there will be the rainbow connection, and I believe that so much, just as I do believe in lovers dreamers. And for me, I believe in the rainbow connection. Thank you again for spending your time with us this week. I'm sorry that the news was not better, but we again make every effort to give you the news as we best see it. And as we discussed throughout this podcast, feel empowered. Feel as in control as one can possibly be with this virus. And if nothing else, believe, just believe that there is a rainbow connection. Stay safe. Stay well. Be kind. Be so kind. Right now, it's tough, particularly as family situations emerge around the holidays. There have always been tough. They've been tough long before COVID, but they get tougher now. Wherever you can, however, you can be kind. That is so important. Thank you. And I look forward to talking with you next week. Bye.

**Chris Dall:** [01:09:57] 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.