

TWiV 1308 Clinical Update

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Guest: Daniel Griffin

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Vincent Racaniello: This Week in *Virology*, the podcast about viruses, the kind that make you sick.

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VR: From *MicrobeTV*, this is *TWiV, This Week in Virology*, Episode 1308, recorded on March 26, 2026. I'm Vincent Racaniello, and you're listening to the podcast all about viruses. Joining me today from New York, Daniel Griffin.

Daniel Griffin: Hello, everyone.

VR: Looks like spring is here.

DG: I usually avoid discussing the weather, but today is spectacular, 70-plus, sunny. What a beautiful day.

VR: That's the end of respiratory season, right?

DG: We're going to get into it, but I think we're getting close. We're almost at what I refer to affectionately as spring break. [laughs]

VR: That's a nice bow tie, very nice, black with red dots.

DG: Actually, if people look closely, it's biohazard, and it's a red and orange biohazard.

VR: Nice.

DG: We've got a lot to talk about today, a lot of fun stuff to talk about. I'm going to start off with-- this is like a quotation and a pick, all tied in together. This is a quotation from Andy Weir's book, now a movie, *Project Hail Mary*. I recently finished reading this. I have not seen the movie, but I'm probably going to try to squeeze that in at some point. Andy Weir, people may know, he also wrote *The Martian* and *Artemis*, another, I guess, less known book because they haven't had a movie with some star in it. The quotation, and you get to comment on this. I don't want to just put it out there.

“Intelligence evolves to give us an advantage over the other animals on our planet. Evolution is lazy. Once a problem is solved, the trait stops evolving.”

VR: I just totally disagree with you.

DG: [laughs] Tell me your thoughts.

VR: Andy Weir is not a biologist. He's something else. I went to hear him speak at an ASM meeting, and people would ask him microbiology questions. He says, "I don't know. You guys are the microbiologists. You know the answers." First of all, we don't talk about things evolving. It's always selection. Nothing stops evolving. There's no endpoint to evolution. There's always increased fitness for the moment, not for the future. When there's another selection pressure, more selection will be applied. I don't think it's right to say a trait stops evolving. Anyway, he's talking about intelligence here, but that's not fair because that's more than just intelligence. A lot of other things that have been selected as well.

I don't think this is a good quote from Andy. It's OK to say it because I understand he's thinking that humans have reached this intelligence, and now it's not going to get any better. It also depends how you define intelligent. I would say people are probably generally smarter now than they were 100, 200 years ago. If anything, they're getting better education, right?

DG: Better education, better nutrition, better environment for development.

VR: They could be smarter, too.

DG: We definitely could be smarter, I'll give you that. It was food for thought. I read this, and I was like, "That's interesting." Now, as people have sort of - this is almost a conversation starter. What is Andy Weir's background? Do you know? He has some science background, obviously.

VR: I don't know. I think he's a computer guy. Andy Weir background. Let's look it up. He's a former software engineer. The thing that kills me, his first book, *The Martian*, it was a PDF you could download for free. That's the way to get people to get interested in your book, right? More people should do that because then they-

DG: Make it accessible.

VR: -decided to sell it, and it still became a bestseller. I think there are lots of authors out there who are equal to or better than Weir. I don't think he's such a great writer. I think his ideas are good, but he's not such a great writer. I think there are a lot of people who are much better writers, but they just never get the opportunity. Maybe his model - now, of course, he doesn't give you PDFs anymore because his publisher says, "No, we can make money on this. Why would you give it away?" I don't know. Your first novel, maybe you'd give it away and see how it catches on.

DG: Then, after there, see if you can earn a living. This is a very interesting next bit of news. "Key Adviser Quits Federal Vaccine Panel." Now, the headline is actually wrong, by the way. We'll talk about that. By the way, because he was kicked off. [laughs] He was told his appointment was null and void. He actually did not quit the federal vaccine panel. He was already basically fired, so to speak, by the judge who said, "These folks just really have no right being here, so they're off." It was disbanded. Then his text message: "If offered the opportunity to participate in a relaunched ACIP, I will respectfully decline."

This was not an impulsive decision. He said, "Hundreds of hours of uncompensated labor, incredible hate from many quarters, hostile press, internal bickering, weaponized leaking, sabotage." He added, "I have better things to do." Now, Dr. Joseph Hibbeln, he's actually a psychiatrist on ACIP or was on ACIP, I guess, right? He often disagreed with Malone. He said

because Malone claims that his stated desire was to avoid drama. He said, "You know what? This contrasts with his prior dramatic and confusing statements. It is good that Dr. Malone wishes to decrease drama regarding vaccines," Dr. Hibbeln said. Dr. Malone also feuded with staff at the health department after ruling.

He claimed in social media posts that the administration would name new members to the committee rather than appeal the ruling. It's really sort of funny. He wants to avoid drama, but he's creating all this drama where there really isn't any drama because Robert Malone, you're no longer on ACIP because you've been kicked off, and no one invited you back.

VR: I think he's just so obsequious. He says hundreds of hours of uncompensated labor. I don't think he read a bloody thing because his comments revealed no understanding of what's going on. It's good that he's gone. I'm very happy. No, I'm not sorry at all. He's frustrated. Too bad. I don't care if you're frustrated. You suck. You should never have been on the committee. Daniel, I'm just worried who they're going to appoint. RFK is not going to appoint Paul Offit, for example, which would be the person to appoint.

DG: I think that basically they're under the directive that if you're going to have an expert panel, it must be constituted with experts, not people like Malone who had an agenda.

VR: If they don't put experts on, is the judge going to say, "This is unacceptable"? I don't think so.

DG: Again, we have really nice, clear precedent here. Go back, it'll be a slam dunk. Say, "Sorry, we've already told you that this needs to be constituted with experts. This is an expert panel, so try."

VR: You know why they're not contesting it? Because it's too visible before the midterms. OK?

DG: I think we're good until after the midterms. Then, hopefully, people vote, and we're good after the midterms. All right, bird flu. I was talking last time about just walking the coast here, the beaches of Long Island, and just seeing dead geese everywhere that had died from the avian flu. Fortunately, today, my wife took the dogs to that same beach, thinking that it was now safe. Dogs are pretty good at finding the last remaining dead birds and eating and rolling in them. That was what we dealt with just before this recording. [laughs]

VR: They ate some birds?

DG: They went ahead, and they started munching and rolling on the remnants of some pretty -

VR: If the Griffin household is ground zero for a H5N1 spillover, that's going to be something. We'll get millions of listeners, Daniel.

DG: [laughs] I'm going to try to avoid. I would rather not have those listeners. [laughs] I'm going to leave in a link here to this article. It's a perspective piece. "Why We Must Vaccinate US Dairy Cattle Against Highly Pathogenic Avian Influenza," so HPAI H5N1. This was published in *JID*. It's not a particularly long piece. They have a really nice graphical abstract. It starts off like, "What's the current situation?" We have sustained H5N1 spread in

livestock. We've already culled over 190, probably over 200 million poultry. As far as herds, we have over 1,000, so 1,086 dairy herds in 19 states affected.

We already have an economic loss of over \$14 billion. The dairy sector loss, 3%, 4% drop in output. Now, the threat and rationale, like why are they saying we should do this? There's three points here. One is, we have increased human exposures via occupation, and this growing interest in raw milk, which we'll talk about. We've had some spillover risk to humans, 71 cases. We've already had a couple deaths. There's the pandemic potential that we've touched upon. Then they go through some different solutions and strategic outcomes, future needs.

VR: I don't know, Daniel. I disagree with this column that says durable and sterilizing immunity is feasible.

DG: I knew sterilizing immunity caught me right away. I'm like, "Really? Sterilizing immunity."

VR: What they say is vaccinated animals, when challenged, they can do that with cows. You can challenge a cow. There's no shedding in milk. OK, but what about somewhere else? Did you check elsewhere? I don't believe it's sterile. It could be for a month after immunization, but did you do long-term studies where you watch the antibody levels go down? That's the key. If they're still shedding, then I don't know how much of an impact this will have.

DG: Do you need to do a cadence here? Do you have to do this every single year, and you've got to show every single year? What people worry about on the other side of this discussion is if you vaccinate the cattle, then they might have more asymptomatic infections. Then they're shedding, and there's issues, and you don't know about it. It's a year and a half later or whatever period of time. The cow seems perfectly fine. You've got no warning that there are all these asymptomatic infection and now you've got this shedding into the milk and spread.

VR: You want to know my solution, Daniel?

DG: Stop drinking milk.

Vincent: We don't need milk. Get rid of the cows. Eat the rest of them, whatever you want to do. Solves the problem.

DG: Plant-based diet.

VR: Use oat milk, almond milk, or any of those things if you need it for your cereal. The chefs are going to be pissed off-

DG: Soy milk, a big fan of soy milk.

VR: -because they will want to cook with milk, right? Solves the problem. By the way, I've done some research in the last few weeks. There is one vaccine that is, in fact, sterilizing. It blocks infection, and that's the HPV vaccine. There's good evidence for that. I looked up the measles vaccine. It does not. About a quarter of vaccinated people develop subclinical infections. No measles, but the virus is reproducing in them. It's not measles. HPV, yes, because antibodies last your lifetime. It's incredible. The plasma cells live forever, and it takes hours for the virus to get into cells, and the antibodies can actually neutralize post-

attachment.

They have a long time to neutralize. It's in a unique biological situation for HPV.

DG: Indiana, 350,000 birds killed in massive avian flu outbreak since the beginning of the month. More than 350,000 birds in Indiana have died from avian flu. Response measures and agriculture officials in the state are asking producers to be vigilant to stop the virus from spreading. Over 10 million Indiana birds have been depopulated since February 2022 due to bird flu. This month's frequent detections and cullings have included ducks, chickens, and table egg facilities, mainly in LaGrange and Elkhart counties.

VR: I don't know what you're going to do about this because this virus is here to stay. It's just going to come back and reinfect whatever new flock you make.

DG: It's a problem. Raw milk, right? Raw milk, apparently, that's the big thing. I just want to point out, here, five children from Tennessee have been sickened with shiga toxin-producing *E. coli*. This is called STEC infections after consuming raw milk produced by the same herd of dairy cows. Four of the five children have been hospitalized. Three have developed what we refer to as hemolytic uremic syndrome, which can lead to kidney failure and death. Tennessee law bans the retail sale of raw milk. They have this system where you buy cows as a group purchase, buying cows or a herd, and then you consume your own raw milk from these animals, so it's a workaround.

VR: I don't know. I take it back that people are more intelligent. I'm sorry.

DG: [laughs]

VR: I take it all back.

DG: All right, norovirus. I wanted to pause here just because we keep seeing a lot of norovirus, and the norovirus continues to be high. There's all these areas where it's high and where we keep seeing cases. There was a little bit of a recent issue where at one of the hospitals that will remain nameless, like, "Yes, we're seeing a lot of these positive norovirus tests in the GIPCR. Oh, GIPCR must be too sensitive. We're going to remove norovirus from the PCR. Then, if you want to do norovirus, you've got to specifically test for it using these other PCRs." There may or may not have been great communication.

For a little while, we were not getting a lot of positive norovirus tests because people didn't know it was not in the GIPCR. They didn't know they had to do that other test. Now that we've figured all that out, yes, we're getting positive norovirus tests again. Why has come up. I just wanted a little bit of a primer on norovirus and a link to the article, "Increasing Predominance of Norovirus." I hate the way they name this, Vincent, because it's like a hybrid of Roman numerals and Hindu Arabic. [laughs] It's GII.17 over GII.14, United States 2022-2025. It's GII.17, which we're now seeing a lot of. It's replaced this GII.4.

This article that I'll leave a link into, genetically, norovirus are classified into 10 Roman numeral genotypes. It's Roman numeral I through X. Then further into 48 genotypes and 60 P types. Now, most of the outbreaks are caused by genotype I and genotype II viruses of those 10 Roman numeral. We have this really nice figure where you can see that it used to be that GII.4 viruses were causing the majority. Now, since 2024-2025 season, over 75% are this new GII.17. What's the relevance here? One is there may be a lack of immunological

prior exposure and serological protection against this. It's one argument.

Some people will argue, "I don't really know how long norovirus protection works," because you can get the same norovirus six months to a year later. That doesn't fully explain it. There may also be some evolution going on here, Vincent. The virus might have changed. I'm sure there's some evolution going on here.

VR: It's not clear. I don't think we know if it's antibody pressure or some other fitness thing that's going on.

DG: Winter vomiting disease, we're seeing a bunch of it.

Measles. I just compared here what's going on with Hopkins versus the CDC. Hopkins has taken on, and now there's more, as per the Hopkins U.S. measles tracker. We already have 1,567 confirmed cases so far this year. We're not that far into this year. Per the CDC, we're up to 1,487 as of March 19. That's another 125 cases just in that last seven-day period. It's going strong. We're going for a 5,000, 6,000 case a year if we keep up this pace.

Flu. Maybe looking a little bit better when we look at our multicolored map of the United States. Still a few pockets like Missouri, out there in the west, Colorado, New Mexico. A lot of the states, we're starting to move down into the low and the minimal levels. If you follow our trend over time, we're almost down to our baseline, which is about 3% of the visits for influenza-like illness being due to coming back with a positive flu test. I think we're almost to spring break. By spring break, I mean a break from the winter viruses, not getting drunk and running around in some beach somewhere.

Unfortunately, we're continuing to see the count of children that died of flu this winter go up. Another 14 influenza-associated deaths in children. Just this last week, we're up to 115 deaths this season. Those will keep coming in. Part of that is not that more children will die, but it takes a little bit of time to count them and verify that that really is what happened. All right, RSV. Maybe it's about to get better. [chuckles] Still at a high level. If you look at our Yale School of Public Health trend, you're actually starting to see it come off that peak.

VR: It's a very unusual peak this year.

DG: It's really late. It almost seems like if you follow the - sometimes we see these later peaks. Hopefully, we're coming off that. We've got some movement on the RSV front. A couple articles to talk about. One is the article, "Immunogenicity and Safety of the AS01-Adjuvanted Respiratory Syncytial Virus RSV Pre-Fusion F Protein Vaccine in Adults Aged 18 to 49 Years at Increased Risk of RSV Disease Compared with Adults Aged 60 and Over," published in *CID*. This was a straightforward, open-label, multi-country phase 3B trial that included 18 to 49-year-olds at increased risk. A control group of folks over 60, with or without chronic conditions.

Primary objective was to demonstrate immunological non-inferiority to the vaccine, Adjuvanted RSV Pre-F3. Now, we've got some pretty nice figures here. Overall, we've got 1,458 adults that were vaccinated. Immunological non-inferiority was demonstrated in the at-risk 18 to 49 versus the greater than or equal to 60 group at one month post-vaccination. Both groups showed increased RSV-A and RSV-B neutralizing titers and specific CD4-positive T-cell frequencies post-vaccination. They declined, but no surprising issues here with adverse events.

VR: This is just in a younger age group than it's been used in before. Is that correct?

DG: Over time, the recommendation for the vaccine, we had shared decision-making, and then we had given it to people 75 and over. Then we added 50 to 75 if there's risk factors. Now, we've basically here said, if we give it to people 18 to 49, we've got immunological non-inferiority. This is going to expand the indication. Anyone at risk, let's say you got chronic lung disease, you can potentially get vaccinated as young as 18 years of age.

VR: What are they comparing it to for non-inferiority?

DG: They're comparing folks who are 60 and over, and they're looking at antibody levels and T-cell. Immunological correlates.

VR: It's funny, they call it non-inferiority. Usually, that's when you're comparing it to another vaccine.

DG: Interesting, yes. It's immunological non-inferiority. In this age group versus that other age group. It's an interesting use of words.

VR: All right, I got it. It was confusing because usually that's comparing vaccines.

DG: We get just as robust a response in the young folks as we get in the older folks. We know in the older folks, it protects you. We're doing correlates here. All right, COVID, Vincent, look at this.

VR: We've gone down finally, right?

DG: I think finally, yes, finally.

VR: We're in the low area.

DG: Yes, I got two consults the other day. I'm like, "What's going on?"

VR: It's not zero.

DG: Don't let an anecdote get in the way of data.

VR: It's not zero.

DG: Not zero. We're still seeing some cases. It's low, but it's on the way down. We're coming into April. It's going to be April, May, June. We're going to get a little break from our respiratory viruses, including COVID, that's now seemingly here to stay.

VR: In July, it's going to start going up again, not too far off.

DG: Yes, it's not a huge break. It's usually in July when it starts to, and by August, September, we're full into it. We'll see if that pattern holds. But there are things you can do. Let's talk about vaccination again. Now, there's this myth out there, and we're going to talk a little bit about it.

VR: Oh, boy.

DG: We're going to discuss the article, "Association Between COVID-19 Vaccination and

Sudden Death in Apparently Healthy Younger Individuals: A Population-based Case Control Study," published in *PLOS Medicine*. Now, Vincent, I suspect that you've already run across this. There's this myth out there that, oh my gosh, all these people, they got a COVID shot, and then they just died, sudden death.

VR: I know.

DG: Then people connect the two. They say, "Since they had a COVID vaccine, that's why they had sudden death." The point is that people have sudden death. We see sudden death in younger adults, younger healthy adults. The question here is, since that's something that we've been seeing for years and years, something we saw before the COVID vaccines came out, is COVID vaccine really associated with a higher incidence? Get your COVID shot, are you more likely to have sudden death, or do you just have the same risk, and we see sudden death?

I think that was that one woman who was telling me about some bad things happened because she got the COVID vaccine, and then her husband, six months later, after his vaccine, finally something bad happened to him. I'm like, "You know -" [chuckles] Anyway, here we have, this is a population-based case control study using linked administrative datasets of residents of Ontario, Canada. Defined cases as those with out-of-hospital death or death within 24 hours of presentation to hospital with a final diagnosis of cardiac arrest between April 1, 2021, June 30, 2023. They matched each case with five controls on age, sex, region of residence, neighborhood income percentile.

They used conditional logistic regression to assess the association between sudden death and previous COVID-19 vaccination after adjusting for multiple potential confounders. Sensitivity analyses were conducted with different definitions of the exposure and subsets of cases. They're really looking through this. Now, they identified 4,963 cases meeting this definition of sudden death. Median age was 36. These are, in general, the younger, healthy adults that people have talked about. 74.4% were male, matching this demographic. In the primary analysis, COVID-19 vaccination was associated with a lower risk of sudden death, adjusted odds ratio of 0.57.

Getting a COVID-19 vaccination actually reduced the risk by 43% of sudden death. We have lots of anecdotes of people having sudden death, but about two times as many of those are in people who did not get the vaccine.

VR: How about that?

DG: They go on. These findings were consistent for COVID-19 vaccination within six weeks before death. In sensitivity analysis, limited to people less than 40 years of age, those who died in hospital or in the emergency departments, and after exclusion of opioid-related deaths. Now, I really like the sensitivity analysis limited to people less than 40 because we hear all these, like, "This young man suddenly died." Adjusted odds ratio of 0.53. Very clear that COVID vaccination in people under 40 cut the risk of sudden death in half.

VR: This is what these anti-vaxxers always wave at you, that the vaccine is causing death. In fact, I don't like the title of this paper because you could just- RFK could wave this manuscript and you could just see the front page, association between COVID vaccination and sudden death. It sounds like there is an association. They should have called it another way.

DG: No, I would have preferred, "COVID-19 vaccination and reduction in sudden death."

VR: This is what happens when you have a pandemic, and you vaccinate a lot of people, right? Other things that normally happen, they're going to get in there, and they're going to continue to happen. Then some people will say, "Oh, it was due to the vaccine."

DG: They'll tell these stories. "I knew this one guy, and you can't tell me otherwise. He got the vaccination, and the next day he was dead." Yes. You know what? The next day, he was going to be dead either way, except actually, the vaccination, if he got three weeks and got some protection, you could have reduced his risk by half of sudden death.

VR: Which raises the question is why is the vaccine protective like that? I don't know because these are not people who had COVID, right?

DG: Not necessarily. Interesting enough, these are people that had sudden cardiac death. Now, we're learning, and I think we're sharing a lot of articles where there may be a connection with sudden cardiac death and cardiac events with prior infections, right?

VR: Yes, true.

DG: Could be flu, could be RSV, could be COVID, even. You guys talked about a deep dive study on maybe some mechanisms here, right?

VR: Yes. The flu in the heart. The virus is infecting cardiomyocytes, and it's actually the interferon response that kills the cells, not the virus.

DG: Yes. These, what was it? Macrophages?

VR: Yes. PDC3s. DC3s, myeloid cells. They come from the lung where they get infected. They go to the heart because they're attracted by CCL2 made in the heart, and then they transfer the virus to the cardiomyocytes. It's very interesting.

DG: A couple others. Now, the other one is people are trying to rewrite history. Oh, it wasn't that bad. I don't know why people did all this stuff. It was only a million people that died. Only a million. Oh my gosh, only 1,000 kids. Just so that people aren't rewriting history, this actually, looking back, it may have actually been worse than we realized. This is consistent with prior studies. The article "Applying Machine Learning to Identify Unrecognized COVID-19 Deaths Recorded as Other Causes of Death in the United States," is published in *Science Advances*.

This article finds, through a different methodology, something previously identified back in 2021, that more people died of COVID-19 than officially counted. Now, in many cases, these are racial minorities. Now, here, these investigators use machine learning trained on U.S. death certificates from March 2020 to December 2021. It's not even that long, right? This is the early two years of the pandemic to predict 155,536 unrecognized COVID-19 deaths during that less than two-year period. This indicates that 19% or more of COVID-19 deaths occurred in the U.S. than officially were reported.

Right in line with that, 20% more from the 2021 study. Again, they found that predicted unrecognized COVID-19 deaths occurred disproportionately among folks that had less than a high school education, those identified as Hispanic, American Indian, Alaska Native, Asian, or Black, counties with lower household incomes, worse preexisting health, counties in the

South. They suggest that the U.S. death toll really was even more than people realized.

VR: Why is this, Daniel? Is it because the death cause is not written on the death certificate, or is it something else?

DG: I think that's part of it, right? If you're a wealthier, educated, white person, and you're sick, and you go to the hospital, and they do the test, and they find out it's COVID, and then you die, OK, you get counted. Let's say you're a minority living in the South, and you die at home. It's just like, "Oh, well, you died. We don't know what that was from."

Now, this next one, I feel like I'm just beating a drum, and I'm going to keep beating this drum, because people still have this idea that this person, they've got this upper respiratory infection. I'm going to whip out one of those antibiotics and use it as an anti-inflammatory. Maybe to my dying breath, right?

Here, they look at this. Here's the deal. The article, "Empiric Azithromycin Alters The Upper Respiratory Microbiome and Resistome Without Anti-inflammatory Benefit in COVID-19," published in *Nature Microbiology*. We discussed how azithromycin was and still is a widely used antibiotic and was frequently used to treat hospitalized patients for COVID-19 and other viral illnesses for the purported anti-inflammatory effect. Now, some of this was driven by a study by a name people may mention, may remember, Didier Raoult. That study was retracted, by the way, like other studies that this man put out there.

Now, in this study that we're going to talk about here, they start by pointing out the impact of empirical azithromycin use on the respiratory microbiome in patients with respiratory infections is unknown. We don't know if you've got a viral respiratory infection, what's going to happen to that microbiome? They used longitudinal metatranscriptomics on nasal swabs from a prospective multicenter cohort. This is 1,164 patients hospitalized for COVID-19. Prospective. They compared the upper respiratory microbiome, resistome, and systemic immune response in patients treated with azithromycin. We've got an N of 366. With those who got no antibiotics, that's 474. Other antibiotics, that's 324.

They found that azithromycin altered the microbiome composition and increased the expression and relative proportion of macrolide, lincosamide, and streptogramin, so basically resistance genes in these bacteria. These changes occurred after only one day of exposure and persisted for over a week. Antibiotic-resistant gene expression was associated with commensals and potential pathogens. While there was, and this is key, no differences in host inflammatory gene expression in blood and airways. Really demonstrating that empiric azithromycin treatment impacts the upper respiratory microbiome. It creates resistant organisms and no anti-inflammatory benefits.

VR: Yet people still use it.

DG: They still do. This myth is out there that it's got some magical, anti-viral, anti-inflammatory property.

VR: That's what the Z-Pak is, right?

DG: It is. The Z-Pak is ingeniously marketed as this five-day Z-Pak. As I tell people, it is ingenious marketing because you wait a couple of days, I'm not getting better, I'm going to go see the doctor, you're going to be better in five, they give you the Z-Pak, you're better in

five, you give the Z-Pak all the credit. You don't get a Z-Pak, you're going to be better in five.

The article, "COVID-19 mRNA Vaccination in Pregnancy and Risk of Infection in Early Childhood," was published in *Pediatrics*. This is a nationwide register-based study from Norway. Conducted between March 2021, December 2023, follow-up through 2023.

Among 146,031 infants born in Norway in this study period, 25% - they worded it in a weird way. They say 25% of the moms were vaccinated while the babies were developing in the womb. The offspring's protection against COVID-19 and the adjusted hazard ratios for hospital contact, ending up in the hospital, was 0.48 for the first two months. More than a 50% reduction in these kids getting COVID or ending up in the hospital, and then it drops to 0.76. Then by 6 months, you're starting to lose the protection.

VR: That's because the antibodies are reducing from the mother.

DG: Then it's time to vaccinate the kids.

VR: It's good. It works.

DG: Moving on to Long COVID. Let's see. I think we've got just one here to wrap us up before we get to email. This is the open access article, "Outcomes of Patients With Neurocognitive Symptoms Attending a Long COVID Clinic." A longitudinal cohort study published in the *Journal of General Internal Medicine*. Observational cohort study where they looked at 150 patients with Long COVID and neurocognitive symptoms. They completed the PROMIS29 inventory at clinic enrollment and six months post-enrollment. The PROMIS29, I'm going to leave a link. You can click on this, and you can see what this is.

It's a 29-item questionnaire asking questions about health-related quality of life across seven key domains. There's a physical function one. There's a section where they ask a few questions about fatigue, a section on pain, depression, anxiety, sleep disturbance, and social participation. Here, we're getting information about patients that received care at the post-COVID recovery clinic at the Ohio State University Wexner Medical Center between 10-12-2022 and 10-23-2023. All the data was extracted from the medical record.

The study consisted of a retrospective arm for patients who had already completed six months of treatment at the start date and a prospective arm for patients who entered the clinic after the start date. They've reported statistically significant improvements in all PROMIS29 domains at six months. Clinically significant improvement was seen for physical functioning, fatigue, social functioning, and pain. Now, improvement was seen in fatigue with symptom, titrated physical rehab. It's a careful way of titrating the physical rehab. In fatigue and pain with Amantadine and memantine, and in sleep disturbance and pain with trazodone and amitriptyline.

It's encouraging that, actually, these folks are getting better. Some of the stuff they're doing is -

VR: That's how you find out. You have to try different things.

DG: It's encouraging. All right. As we've been saying for a while, no one is safe until everyone is safe. We're at our Floating Doctors fundraiser. This is going to go February through April. We're going to be doubling your donations. We're going to be sending a

maximum donation up to \$10,000. If you guys were a little more generous, we could potentially go a little higher. I know a lot's going on, and the economy's tight and a lot of affordability issues out there. Go to parasiteswithoutborders.com. Click on Donate. Help us continue to fight this misinformation with science education.

VR: It's time for your questions for Daniel. You can send yours to daniel@microbe.tv. Jason writes, "For high-risk occupations and groups of people for COVID exposure, infection, and reinfections, what does the current evidence show happens to these groups in terms of any long-term effects? Even if there are long-term effects, do the vast majority show no real significant impairments? Does each subsequent infection get milder and milder?"

I'm thinking about groups like correctional officers, emergency medical services personnel, fire service workers, healthcare workers, nursing home residents, people who travel in airports, and maybe people who attend frequent meetings with large numbers of people in compact areas." Like ASTMH.

DG: Jason, this is tough because, as we've seen, every time you get COVID, there's always this risk; there's always a 1% or so of folks who just months later are still struggling. It's not always true that each case is milder than the last one. Sometimes we see people, oh, was it mild the last time? This time I'm in the hospital. This time I'm out of work. This time, I'm still sick two months later. It's not great, these repeated COVID exposures and infections. We've talked about some of the impacts of that. This is not great. What's really the best thing you can do for all these people that have these exposures that just come with how they're trying to pay the bills? Vaccination.

There's a cadence to that depending on your age and your immune status. Then you're trying to do the other things. I see these massive lines at these airports, people crammed in, people coughing away. Fortunately, we're coming out of the winter respiratory season, but that's times when you might decide masking, keeping your distance, other non-pharmacological, non-vaccine strategies to reduce your risks.

VR: Linda writes, "Do you know anything about an increase in Creutzfeldt-Jakob disease in states where deer have chronic wasting disease? I've read that no connection has been proven, although people known to eat venison and even infected venison have succumbed. It appears that mountain lions kill CWD deer, and their digestive systems destroy the prions. Yet here in Utah, the DWR is doing a study in which it will kill as many lions as possible and see if that will increase the deer population." What a screwed-up study. Oh my God. "I have asked for the research design to no avail. Beyond that, shouldn't we be concerned about a prion disease? My family loves *TWiV*." [chuckles]

DG: I'm still a little bit in shock. I have to say these mountain lions are just magnificent animals. I was just talking to a woman up the street when I was walking the dogs earlier, and she has one of those - it's a failed guardian dog. It did the training to become a guardian dog in some of these areas where they have these large cats, which are magnificent. Some of these larger dogs, like the Great Pyrenees and related types of dogs, are trained and they protect the livestock. There's ways to address this. You do not need to kill all the lions. I'm trying to like - you're doing this because you want to increase the deer population? Usually, most of us are trying to reduce the deer population because -

VR: It doesn't make any sense at all.

DG: - none of it makes any sense. It just sounds horrible. Here's what I will say. We don't know when it comes to this issue with the prion disease in the deer and the chronic wasting disease. We haven't seen this problem. There doesn't seem to be a correlation here. There was an article, I'll leave a link into it. It was last summer, "A Lack of Transmission of Chronic Wasting Disease Prions to Human Cerebral Organoids." It's a cool way of testing it out. It got taken two ways. The media was like, "Oh, it proves that it's fine and you don't have to worry." The authors were like, "No, we did not prove that it's fine. It just suggested a low risk."

That's why in a lot of places, particularly out west, they actually have these places where they stop. They do testing before the hunters eat them just to reduce any potential exposure because every exposure is this evolution opportunity that we really don't want to provide for the prions.

VR: There was a case, it was reported in *Neurology* recently, where two men who ate deer died, and they died of Creutzfeldt-Jakob, but they don't know if the deer were CWD positive. Both men had an amino acid change in the prion gene that predisposes you to sporadic Creutzfeldt-Jakob. It's not at all clear what was going on there. It's unusual that two old guys who ate deer got the same disease, but there's, again, no proof that it was CWD.

DG: I think you talked about that on one of the other podcasts. It makes you wonder. It seems suspicious, but then on the other - you live out west, and we eat deer, we eat elk. [chuckles] When we lived out there, we had a freezer full of elk and buffalo and then some venison thrown in.

VR: It's interesting that the mountain lions, if they kill deer, so it's true, their digestive system can destroy the prions, like 96% reduction of infectivity. That's amazing because they're pretty resistant to a lot of things.

DG: Wow, I like that.

VR: Ursula writes, "I am a longtime listener. Your podcast is amazing. Thanks for maintaining us informed. Can you please include the meningitis outbreak of the UK in your program? Apparently, the worst outbreak seen for quite a while." Ursula provides a *Telegraph* article on this. I have a case in London now.

DG: This is tough. In the UK, normally, they see maybe 300 to 400 cases of meningitis per year. Now, think about that. It's case one or two here or there. The meningitis is contagious. Here, they saw, I think it was 15 cases in a matter of 48 hours. A pretty significant number of cases, really, in a short period of time. It's meningitis B. There's different types of meningitis. It's either basically five different types. One vaccine covers A, C, Y, W. The other vaccine covers B. In the U.S., we actually recommend the vaccination to basically all, the quad plus the B. We do that. Unfortunately, the protection, we think it only lasts for a period of time.

We'll give it to kids when they're younger. We give it to them right before they go off to university. A lot of kids are doing that these days. Military, it's another one we think about doing in those kind of settings. These large communal settings. We've had a few outbreaks in my career at some of the universities. This is one of their most concerning ones in a number of years, with just so many individuals in such a short period of time. It's really interesting. You can look at links that are not paywalled, like *Telegraph* from the UK. They do not vaccinate routinely for meningitis, the adolescents and young adults in the UK.

They've analyzed it and felt like it wasn't cost-effective. But, 300 to 400 cases a year, it's a concern.

VR: Lisa writes, "I listened to this *Guardian* podcast episode this morning. It's explaining meningitis. I was wondering about the discussion of the use of antibiotics or vaccination to protect the people who are exposed. In particular, I was puzzled by the comment that prescribing prophylactic antibiotics, in this case, wouldn't have risks with respect to antibiotic resistance. I don't understand why antibiotic resistance wouldn't be a concern for any disease. Although I can see how, with a very dangerous infection, it wouldn't always be the biggest concern.

I'm thinking that since *Science Weekly* reports are short, there's a fuller explanation that would have been clearer that couldn't fit into the episodes. What are your thoughts?"

DG: Every time you use antibiotics, as we saw with azithromycin, it was one day, and you're already seeing resistance, and it's lasting for a period of time. Usually, for prophylaxis here, you're using things like rifampin, ciprofloxacin. Now, if you get exposed and you've gotten that antibiotic, the idea is it's such a low number of organisms that really not going to put enough selective pressure to select for something resistant. Bigger picture, you've got all these microbes in your body. You've just let all the other microbes see, usually a single or a short course of antibiotics. Yes, there's going to be some selective pressure there.

VR: MR writes, "I love your weekly *TWiV* podcast. I listen every week without fail. Vaccine frequency has become confusing, to say the least. Today, I'm wondering whether adults over 65 should be getting a twice-yearly COVID booster. I think so, but my friends are all doubtful. We are all over 75, got COVID boosters last October '25, and have the usual array of senior issues, cancer survivors, high blood pressure, et cetera. If COVID is a six-month ritual, this would be the time. Could you enlighten us? There doesn't seem to be a link on the *TWiV* site. Many thanks, and again, keeping us safe from the dark forces of ignorance."

DG: Let's talk about the science here. One of the unfortunate things about the COVID vaccines is we see most of the protection in six months. We even saw that with the study we talked about earlier. You get the vaccination, about two to three weeks later, you've got this nice boost, and then you have a decreasing level of protection. Great during that first one to two months, OK at three to four, but then five to six, it starts to decline. Now, unfortunately, the problem is COVID has these two spikes per year, these two rises, surges per year.

We're desperate to want to do what we do with flu. We're desperate to just make it once a year, which really ends up, as we're starting to see, with a bigger surge in the summer sometimes than in the winter because we don't have vaccination helping us out. The science still makes sense. Let's say you get your booster in early October, that's going to give you great protection for November, December, January, February, March, this winter. Now we're through it. Then we'll probably start to see things rise in July. Your timing on the next shot is probably June. That would be the science. As we've seen, all the craziness, all the reversals of recommendation, they've all been nullified. We're back where we were.

In general, everybody gets a shot in the fall, and then folks 65 and over, people with immune issues, they should probably get one every six months. Get your shot in early October and get your shot in end of June.

VR: Speaking of the evolution of intelligence, what about the evolution of ignorance, Daniel?

DG: Isn't that amazing? The selective pressure is - [chuckles] Are we selecting for ignorance?

VR: That's *TWIV* weekly clinical update with Dr. Daniel Griffin. Thank you, Daniel.

DG: Oh, thank you. Everyone, be safe.

[00:51:23] [END OF AUDIO]