

TPWKY

This is Exactly Right.

Erin Welsh

"The real and terrible consequence could be seen on CT scans, MRIs, and ultrasounds. Those tiny heads contained shrunken brains. Sometimes just the frontal lobes, the seat of decision making, of speech, of intelligence, of humor were atrophied, showing abnormally large, dark ventricles, the hollow internal spaces that are supposed to appear smaller and smaller as the brain grows. Sometimes all that was left was the bulb above the brainstem where the most basic functions like breathing and digestion reside. Around it would be blank space filled with cerebrospinal fluid. Usually the skull had not completely collapsed but neither had it pushed out to its full size by the growing brain. And the brain would be smooth, looking more like a small liver with none of the deep folds and fissures that every growing brain should develop as it folds in upon itself to pack more thinking power into a small space.

That smooth brain baby might be more than comatose, maybe it could breathe, could blink, could digest, could live, but maybe that baby could not chew food or see the spoon or the breast coming toward its mouth. Certainly it would never walk, probably never crawl, or maybe would never do more than roll from side to side, unable to control its contorted arms and legs enough to even turn over. Hospital hallways, doctors remembered in Brazil, were lined with mothers who resembled ghosts. They were in shock, mute, expressionless, bleak. Some were just teenagers, some had ridden buses for hours and were too poor to buy food as the hours waiting to be seen stretched on. And there were so many of them. One mother looked up from her son's face to ask, 'Doctor? His head is going to grow, right?'"

TPWKY

(This Podcast Will Kill You intro theme)

Erin Allmann Updyke

Jeez. Yeah it was really intense but that's also the reality of Zika.

Erin Welsh

Yeah.

Erin Allmann Updyke

It's...dang.

Erin Welsh

Yeah. It's awful. It's really awful.

Erin Allmann Updyke

Yeah.

Erin Welsh

So that firsthand, that really horrible, sad description is from a book called 'Zika' by Donald McNeil.

Erin Allmann Updyke

Okay.

Erin Welsh

Well.

Erin Allmann Updyke

Well hi.

Erin Welsh

Hi.

Erin Allmann Updyke

(laughs) We always manage to start on really great notes on this podcast.

Erin Welsh

I mean what's this podcast about? Oh yes.

Erin Allmann Updyke

Yeah.

Erin Welsh: I'm Erin Welsh.

Erin Allmann Updyke: And I'm Erin Allmann Updyke.

Erin Welsh: And this is This Podcast Will Kill You.

Erin Allmann Updyke: And today we're talking about none other than Zika virus. Heavy.

Erin Welsh: Yeah. Well they all kind of are really.

Erin Allmann Updyke: It's true.

Erin Welsh: Okay well so before we move on to hear more about just how awful Zika is, let's arm ourselves with a stiff drink.

Erin Allmann Updyke: Let's do that.

Erin Welsh: Or a placeborita. So it's quarantini time, I believe.

Erin Allmann Updyke: It is definitely quarantini time. So this week we're drinking the Pinkeye of the Tiger.

Erin Welsh: And why is it called that?

Erin Allmann Updyke: Well in part, as we'll discuss in the biology, because Zika is transmitted by the tiger mosquito and in part because one of the symptoms is conjunctivitis.

Erin Welsh: (laughs)

Erin Allmann Updyke: We're punny as heck today, Erin.

Erin Welsh: Just wonderful.

Erin Allmann Updyke: So what is in Pinkeye of the Tiger?

Erin Welsh: Okay so it is a little bit of raspberry sorbet, a little bit of mango and passionfruit-infused vodka.

Erin Allmann Updyke: Thanks to my brother Josh who can't hear this but I'll thank him anyways for that gift.

Erin Welsh: And then you top it up with some champagne.

Erin Allmann Updyke: Yum.

Erin Welsh: Yeah it's actually quite delicious.

Erin Allmann Updyke: Delish. And as always we'll post the recipe for our quarantini as well as the nonalcoholic version, our placeborita, on all of our social media channels. So @TPWKY on Twitter and @thispodcastwillkillyou on Facebook and Instagram as well as our website.

Erin Welsh: Cool. I want to hear about Zika. I want to hear about... This is a bizarre little virus.

Erin Allmann Updyke: It's very bizarre and it's new for many of us so let's get into it. I'm excited to tell you about the biology.

TPWKY: (transition theme)

Erin Allmann Updyke: So we've actually gotten a fair number of requests for Zika which is exciting. And what I think is so interesting and I can't wait, Erin, to hear about the history of it is that if we had talked about... I mean if we had started this podcast a few years ago I don't even think we would have proposed doing Zika virus because I don't even know that I heard of it before like 2015.

Erin Welsh: No. Definitely not.

Erin Allmann Updyke: Yeah. It was not on almost anyone's radar.

Erin Welsh: Yeah.

Erin Allmann Updyke: So in that way it's really exciting because so much of Zika is just brand spanking new.

Erin Welsh: Yeah I mean it's still happening.

Erin Allmann Updyke: Right but it don't wanna steal your thunder about the history.

Erin Welsh: You won't.

Erin Allmann Updyke: So let's just talk about the virus itself and how it makes you sick. Okay. So Zika virus is a virus, that's obvious.

Erin Welsh: Is it? (laughs)

Erin Allmann Updyke: It is. You know we could go crazy and call something Zika virus and have it be a...no. It's a virus. It's in the family Flaviviridae and so perhaps some really deep listeners or recent binge listeners might remember another disease we've covered that's in the same family? Erin do you remember?

Erin Welsh: This is gonna be embarrassing. Is it yellow fever?

Erin Allmann Updyke: It's yellow fever. (laughs)

Erin Welsh: Okay good.

Erin Allmann Updyke: Great job.

Erin Welsh: The amount of stuff I can forget is impressive.

Erin Allmann Updyke

Oh, same. But you got it right, it's related to yellow fever, also to dengue, Japanese encephalitis, West Nile, bunch of other viruses. So it's an RNA virus and like all of those other viruses that I mentioned, it's transmitted by mosquitoes. Zika happens to be transmitted by the same mosquitoes that transmit yellow fever and dengue virus and chikungunya but those are all different stories. And that's *Aedes aegypti* and *Aedes albopictus*, so that's the yellow fever mosquito and the tiger mosquito. Both of which if you live in a place where they exist then you've definitely noticed them because they're gnarly biters, they bite humans like prolifically, they love humans and they bite hard and it hurts and they're big and black with white stripes on their legs.

Erin Welsh

Oh yeah. And they bite often.

Erin Allmann Updyke

They bite often and they also are like daytime biters. So they'll bite you all day long, they're not like other mosquitoes that will only bite at like dawn or dusk-

Erin Welsh

Corpuscular, it's one of my favorite words.

Erin Allmann Updyke

Exactly. It's a good word. And so diseases that are spread by these mosquitoes like yellow fever, dengue, Zika, they're especially difficult problems to deal with in part because of how well adapted these two species of mosquito are to the urban and peri-urban environment. Na dhow much they love humans and the environments that we create for them. So it's really fun. When you combine that with climate change and how they're expanding their range, these diseases aren't gonna stop being an issue any time soon.

Erin Welsh

And urbanization and land use change and clear cutting forests.

Erin Allmann Updyke

Yeah. All the things!

Erin Welsh

All the things.

Erin Allmann Updyke

It's just so fun.

Erin Welsh

Good news from our corner, everyone.

Erin Allmann Updyke

Right? Job security! Okay so one of the things though, although Zika is transmitted primarily by mosquitoes, one of the things that we discovered relatively early on during the most recent outbreak that's pretty novel and very scary is that it can also be transmitted sexually.

Erin Welsh

Oh yeah.

Erin Allmann Updyke

So the virus somehow seems to be able to live in especially the male reproductive tract. I don't know exactly where, I don't think we know as science exactly where in the reproductive tract of humans it happens to live but it can live there and be transmitted weeks or even months after a person was infected. And most of the cases of sexual transmission have been from symptomatic people and usually it's transmitted via semen. But you can also transmit it to your partner even if you've been asymptomatic which is really scary cause it means that you could potentially be a carrier, never know that you're infected, and then end up transmitting it to a partner.

Erin Welsh

Yeah.

Erin Allmann Updyke: Yeah it's something that's pretty novel and quite frankly scary in looking at something that's normally a vector-borne disease because it really adds a whole other layer of complexity to control efforts.

Erin Welsh: Right.

Erin Allmann Updyke: Which are already really difficult when you're dealing with vector-borne diseases.

Erin Welsh: Yeah. I can't believe how long it lives.

Erin Allmann Updyke: Yeah.

Erin Welsh: I read something about someone who, it was circulating, they found traces of the virus in their semen 62 days after exposure or something like that or after first being positive. What?

Erin Allmann Updyke: Yeah. And the thing is that since we don't know, like there's so much that we don't know about this virus, we don't know like is 62 days the average or is that the maximum? Right, we don't know. Or is that just like maybe on the low end, maybe it could live for 6 months or a year. Who knows? We don't know at this point.

Erin Welsh: Oh man.

Erin Allmann Updyke: And there's one other way that Zika can be transmitted and that's vertically. So vertical transmission is from mother to baby and so in this case Zika can actually cross the placenta and be transmitted to the fetus during gestation. And while this is not uncommon for viruses in general, there's a number of infections viral and bacterial that can cross the placenta, it wasn't known at all that Zika could be transmitted this way until very recently. And as far as I know it's not that common for mosquito or vector-borne diseases to be able to cross the placenta.

Erin Welsh: Yeah I don't think so.

Erin Allmann Updyke: Yeah. But it's not that out there just in terms of a biology perspective, there's a number of viruses and bacteria that can cross the placenta. So those are all the ways that you can get infected with Zika.

Erin Welsh: Fantastic.

Erin Allmann Updyke: So the question is what happens once you get infected.

Erin Welsh: Yeah.

Erin Allmann Updyke: Yeah. Okay so the most common way that you get infected, right, is via mosquito. So if you get bitten with an infected mosquito, the incubation period which is again the time from when the mosquito bites you and dumps a bunch of virus into your bloodstream until the time that you show symptoms, that time period is usually between 3-14 days. So usually within 2 weeks you'll start to show symptoms.

Erin Welsh: Okay. That's again a long span.

Erin Allmann Updyke: It's a pretty long span, yeah. But again that has to do in part with just your immune system and then in part with how many viruses was the mosquito infected with and blah, blah, blah.

Erin Welsh: Right. How long it was feeding on you, etc, etc.

Erin Allmann Updyke: Yeah, all those things.

Erin Welsh: All the things.

Erin Allmann Updyke: So the symptoms in this case are actually very mild. Fever, rash and the rash is one of the features that seems pretty prominent in Zika virus compared to other flaviviruses. Like most of the time if you're going to have symptoms with Zika you'll probably have a rash, also conjunctivitis, hence the name of our quarantini.

Erin Welsh: Pinkeye!

Erin Allmann Updyke: Pinkeye.

Erin Welsh: Raise your hand if you had pink eye as a kid!

Erin Allmann Updyke: Who didn't?

Erin Welsh: Oh yeah.

Erin Allmann Updyke: Everyone did right, we weren't just filthy?

Erin Welsh: I don't know, let us know, people.

Erin Allmann Updyke: Okay. (laughs) so those are really common. Also muscle and joint pain and that's something that's really common with a lot of flaviviruses. Malaise, headache, these are all things that are pretty typical if you get any kind of viral infection and they're also very nondescript which you can imagine makes it very difficult to diagnose.

Erin Welsh: Yep.

Erin Allmann Updyke: Right?

Erin Welsh: Sure does.

Erin Allmann Updyke: And symptoms are pretty self-limited, they usually only last between 2-7 days. So we're talking like the flu length but not even as severe as the flu probably.

Erin Welsh: Right.

Erin Allmann Updyke: But what's really important is that up to 80% of people who are infected with Zika virus don't ever develop any symptoms.

Erin Welsh: That's, yeah. I read that. That's amazing.

Erin Allmann Updyke: Yeah, yeah. And it just makes it so difficult to try and get a handle on how many people have been infected and everything because if you've got 80% of people never showing symptoms, oof. It makes it tough.

Erin Welsh

Yeah.

Erin Allmann Updyke

And so in general this infection happens in a very similar way as any other flavivirus or really any other virus or mosquito-borne virus and that is the virus gets into your skin because the mosquito pokes a hole in it, it goes into your lymph nodes and then into your bloodstream. And it replicates and it invades cells. So how exactly Zika virus infects you specific cells and causes damage we don't entirely know. So we don't know the exact pathophysiology of Zika virus yet.

Erin Welsh

Okay.

Erin Allmann Updyke

Which means that it makes it a little bit harder to target.

Erin Welsh

And it's suspected to act differently than other flaviviruses?

Erin Allmann Updyke

I don't know the answer to that question.

Erin Welsh

Okay.

Erin Allmann Updyke

(laughs) But Zika virus particles can be found in almost every bodily fluid that we have tested so far. So if you test the blood of someone who's been infected with Zika, you'll probably find Zika virus. If you test their semen, if you test vaginal secretions, if you test their eye fluid, if you test their saliva, if you test almost any bodily fluid or almost any organ, you'll probably find Zika virus particles.

Erin Welsh

I have a question about bodily fluids.

Erin Allmann Updyke

Okay.

Erin Welsh

Do boogers and snot count?

Erin Allmann Updyke

Totes. Yeah.

Erin Welsh

Okay.

Erin Allmann Updyke

And so on top of the sort of general nondescript symptoms, there are a number of different complications that can arise as a result of Zika infection. So there's an increased risk for future neurologic complications like Guillain-Barre syndrome, myelitis, general nerve issues, and also things like meningitis are possible as a result of Zika virus infection.

Erin Welsh

Right.

Erin Allmann Updyke

But the biggest complication that we mentioned in our firsthand account and that people, it has probably become the most famous is that 5-15% of infants born to pregnant women who are infected with Zika during their pregnancy have evidence of complications directly related to Zika virus infection. These complications include intrauterine growth restriction which means the baby's not able to grow as big as it should, early pregnancy loss also known as spontaneous abortion, and microcephaly which is a small brain that's inadequately developed and in some cases can be incompatible with life. So this is sort of the most extreme complication and the most devastating complication that has come from Zika. The exact mechanism of how this happens is not clear.

Erin Welsh

Are there thoughts as to what it might be?

Erin Allmann Updyke

Well so shortly after the connections between Zika virus and microcephaly were sort of brought to light, there was a lot of push back because it's only 5-15% of cases and that seems pretty low and in some areas the baseline levels of microcephaly weren't necessarily known at the time. But since then multiple different animal models have shown that Zika is capable of crossing the placenta and in mouse models can cause fetal defects, I believe in monkey models, nonhuman primate models as well. So at this point the link is pretty clear but we don't really know exactly what is happening besides that Zika is able to invade, cross the placenta, and then infect the fetus.

Erin Welsh

Okay.

Erin Allmann Updyke

Yeah.

Erin Welsh

You might have said this but I don't remember. Any trimester? Is it any trimester for infection that's dangerous?

Erin Allmann Updyke

Great question. So the number or the percentage of birth defects is highest in women infected during the first trimester but it is possible to end up having a baby born with congenital malformation if you're infected at any point in the pregnancy.

Erin Welsh

Okay.

Erin Allmann Updyke

But what I think is scary is that when you combine this complication with the fact that Zika can be transmitted sexually, that's a pretty sinister picture of a disease to me.

Erin Welsh

Yeah.

Erin Allmann Updyke

It's pretty depressing.

Erin Welsh

Yeah.

Erin Allmann Updyke

That's all I've got. That's Zika virus.

Erin Welsh

It's a scary and really tragic one.

Erin Allmann Updyke

It really is. It really is.

Erin Welsh

Yeah.

Erin Allmann Updyke

So what the heck, Erin? What's going on? How did we get here? Where'd this thing come from? How did it just pop up in 2016, no one had even heard of it? Is it brand new?

Erin Welsh

Well the Romans called it... No, just kidding. (laughs) Okay.

TPWKY

(transition theme)

Erin Welsh: I feel like we all know the history of Zika or at least a big part of it. I mean we've lived it more or less, like we've been there for it. Maybe not in the epicenter but we remember the headlines at least. I can remember the panic and headlines of 2015 and 2016 and I'm sure you do too. I was living in Panama for much of the peak of media hysteria and I remember all sorts of rumors just in Gamboa about the danger of Zika and how pregnant female researchers weren't going to be allowed to conduct research in Panama. And I think that the week I was visiting San Blas there was an outbreak of Zika declared there that was like, 'Ah! Zika in San Blas!' And I was like, 'Okay! At least it's mild.' Or something like that stupid that I was thinking.

Erin Allmann Updyke: Oh yeah I was the same way. I was like man, maybe I should just try and get Zika now so then I've had it. (laughs)

Erin Welsh: Yeah I mean I really wonder if we tested antibodies whether we would have shown exposure.

Erin Allmann Updyke: Actually I was tested because if you give blood in the U.S. now they test you for Zika and they call you if it's positive and mine was negative, so I didn't get Zika.

Erin Welsh: Oh okay so you never got Zika.

Erin Allmann Updyke: Yeah.

Erin Welsh: So for every disease or topic that we cover I try to ask myself the question what does this specific disease or outbreak teach us about epidemic response or the nature of disease or often humanity itself? And I think in this way Zika is one of the first epidemics to show us how fast information and especially misinformation can spread. In many ways though, that just kind of shows us how little things change. Rumors and conspiracies thrive during epidemics, someone's always wanting to go against quote "conventional wisdom". Sometimes they're right, most times they're not. And it just moves at a faster pace and with a higher turnover in this internet age.

Erin Allmann Updyke: Yeah, thanks Twitter.

Erin Welsh: Age of Twitter. And so does the virus itself thanks to global travel.

Erin Allmann Updyke: Yeah.

Erin Welsh: Even though the first time that many of us heard the word 'Zika' was probably in 2015 in connection with the words 'microcephaly' and 'Brazil', the Zika virus had actually been known for almost 70 years.

Erin Allmann Updyke: Ugh, that's amazing!

Erin Welsh: (laughs)

Erin Allmann Updyke: I didn't know it was 70 years. I knew it was a long time but dang.

Erin Welsh: Yeah.

Erin Allmann Updyke: That's a long time.

Erin Welsh: Yeah. Did you come across the meaning of Zika in any of your readings?

Erin Allmann Updyke

No!

Erin Welsh

Okay. My favorite part. It actually means overgrown.

Erin Allmann Updyke

What?

Erin Welsh

Yeah. So it's taken from Zika forest in Uganda which is close to Entebbe where the Rockefeller Foundation established its Virus Research Institute in the 1930s. The swampy, hot Zika forest was the perfect place to accomplish some of the goals the Research Institute had laid out including understanding mosquito ecology, exploring which animals are susceptible to different viruses, and the big one, discovering new viruses. And this is a common theme in so many early quote "global health institutes". The primary focus was research, not intervention. That brings with it a whole other set of issues about the ethics of early global health research but anyway.

Erin Allmann Updyke

For sure.

Erin Welsh

So to conduct this research, scientists suspended cages containing sentinel monkeys of various species in the forest canopy. Then they would pull them down occasionally for inspection and temperature taking. Sounds like a really wonderful way to live a life, right?

Erin Allmann Updyke

Oh my god, how sad. To be a monkey in the forest, so you can like see your friends and you're in a cage your whole life.

Erin Welsh

Well and some weren't from Uganda, some were from various Asian countries.

Erin Allmann Updyke

Oh cool.

Erin Welsh

So extra cool.

Erin Allmann Updyke

Even better.

Erin Welsh

Yeah. One day, April 19th, 1947 to be exact cause you know how I like to be exact.

Erin Allmann Updyke

Of course.

Erin Welsh

A monkey with the charming name of Rhesus 766 was observed to have a high fever, 104 degrees Fahrenheit, 40 degrees Celsius now that I'm in Finland. Blood was drawn and processed and in it scientists found what they called a filterable transmissible agent which back then often meant I was a virus, something they couldn't easily culture. But this still left many questions. First was it a new virus, meaning undiscovered? And was it mosquito-borne? To answer the second question they had to collect many mosquitoes from the same areas that Rhesus 766 had been kept and then test whether these mosquitoes carried anything resembling this virus which meant grinding up and filtering the mosquitoes and injecting the slurry into the mice or monkeys they had on hand. And then comparing that to the infection caused by the filterable transmissible agent that had originally come from Rhesus 766.

Erin Allmann Updyke

Man. That just sounds like... You can have co-infections, this sounds like a messy way to try and figure out what's going on.

Erin Welsh

I think they just didn't know any other better way to do it.

Erin Allmann Updyke Oh yeah, for sure. Yeah like what else are you gonna do?

Erin Welsh I don't know if it would've had the patience to be a microbiologist back then or a virologist.

Erin Allmann Updyke I don't even have the patience for it now.

Erin Welsh (laughs) Fair point, fair point.

Erin Allmann Updyke That's why I do this podcast instead.

Erin Welsh Finally they would test this new mosquito-derived slurry on a monkey that had recovered from an infection with the original virus. Yeah, full circle. And the results of those experiments confirmed their hunch. The virus was mosquito-borne, transmitted specifically by the species in this case *Aedes africanus*. But still they didn't know whether this was a new virus or one that was already known. Since it was 1947 they couldn't test for specific genetic material but they could see whether the virus could be neutralized by antibodies against known viruses. And they found, as you can guess, that this was a brand new virus. So they named it Zika because why wouldn't you name it after a geographical place? Just kidding. And then it all but dropped off the face of the earth.

Erin Allmann Updyke Yeah.

Erin Welsh From 1947-2007, 60 years.

Erin Allmann Updyke 1947 they discover it, they're like, 'Cool we got a new virus.' Nobody cares. 2007, tell me what happened.

Erin Welsh Well I should've maybe kept going. (laughs)

Erin Allmann Updyke Oh, sorry. You can just keep going then.

Erin Welsh From 1947 to 2007, 60 years, only 14 cases of active human infections with Zika were described. 14. So in 60 years.

Erin Allmann Updyke And were those all in Uganda?

Erin Welsh No. So they were in various places, sometimes they were specified, sometimes they weren't. They weren't necessarily all from Uganda.

Erin Allmann Updyke Okay.

Erin Welsh So this list includes a 10 year old girl from Africa whose home country was not specified who had a fever and headache and antibodies against Zika and then there was a researcher who decided to inject himself with the Eastern Nigeria strain of Zika.

Erin Allmann Updyke Genius.

Erin Welsh Yeah I think he was like, 'Oh it's mild! I wanna be the first one to describe this about myself.'

Erin Allmann Updyke Oh jeez.

Erin Welsh Whatever. And there were some other people here and there.

Erin Allmann Updyke All in Africa?

Erin Welsh Yeah.

Erin Allmann Updyke Okay.

Erin Welsh So most of these Zika cases were detected in Africa but at some point in the 1960s the virus moved to Asia, popping up in Malaysia, Pakistan, and Indonesia in the late 60s and 70s.

Erin Allmann Updyke Okay.

Erin Welsh And then Zika began to pick up steam.

Erin Allmann Updyke Yes!

Erin Welsh Here's where we get rolling. In 2007 a bunch of people on Yap, which is an island in the Caroline Islands group in the Western Pacific, started showing symptoms of something that resembled dengue but was much milder. This infection was also accompanied by a rash and tests for dengue came back negative. This sudden outbreak prompted a physician working at the Yap Department of Health Services to reach out to the CDC for help. The CDC deployed some EIS agents and they began the hunt.

Erin Allmann Updyke Ugh, our dream. My dream. My dream job.

Erin Welsh My dream too. (laughs) Sample after sample back positive for Zika which was bizarre. In the 60 years of Zika history at that point the virus had never been responsible for a large outbreak. It was barely recognized to be a disease-causing pathogen in humans.

Erin Allmann Updyke Right it's just like oh yeah, 4 people have gotten sick, they had a headache.

Erin Welsh Yeah, yeah. And when I say a large outbreak I mean that an estimated 73% of Yap's 7000 inhabitants became infected with Zika over a 5 month period.

Erin Allmann Updyke Whoa!

Erin Welsh 73%.

Erin Allmann Updyke Like 73% had symptomatic illness?

Erin Welsh No. So 73% was estimated based on those who did have symptomatic illness.

Erin Allmann Updyke Oh interesting.

Erin Welsh So this is based on the 20% symptoms, 80% asymptomatic breakdown.

Erin Allmann Updyke

Okay, okay. Wow though. 73%.

Erin Welsh

Yeah. And then just like that it faded away.

Erin Allmann Updyke

2007, gone. So 1947 pops up, nobody cares, nobody cares. 2007, what's going on? Then nobody cares. (laughs)

Erin Welsh

Yeah basically. (laughs) Because of the mildness of symptoms, if you were even unlucky enough to have symptoms. The hospitals and clinics weren't overwhelmed by people seeking treatment and so yeah it just showed up, it spread through the population like wildfire and it disappeared without seeming to leave any substantial damage in its wake at first. But before the aftershocks of Zika would be recognized, the virus made its second dramatic appearance again in a Pacific Island group, this time in French Polynesia. In October in 2013, 6 years and a few months after the Yap outbreak had ended, alerts went out about a bunch of people with rashes, fevers, bloodshot eyes, swollen joints, with most of these cases occurring on Tahiti. Again dengue was the primary suspect and that in itself was worrying. The first time you get dengue can be excruciating, they don't call it breakbone fever for nothing. But if you are exposed to a different serotype you can actually get something called dengue hemorrhagic fever or dengue shock syndrome which can kill you much more easily.

Erin Allmann Updyke

Yeah.

Erin Welsh

So if this was a new type of dengue that the island group hadn't seen before, that was very concerning.

Erin Allmann Updyke

Yeah.

Erin Welsh

But again, tests for dengue came back negative. And again the true culprit was found to be Zika virus. As with the Yap outbreak, a large proportion of the population of Tahiti became infected with Zika with the majority of infections being asymptomatic and the cases that were symptomatic tended to be again mild, rarely requiring hospitalization. But then something started happening. The first indication that Zika was not as benign as it seemed. Here and there a person infected with Zika would show up to the hospital a couple weeks after their illness and report with partial paralysis. These cases were determined to be Guillain-Barre syndrome and the link to Zika was pretty clear, at least statistically. Where in previous years there would be 3-5 cases of Guillain-Barre, now there were dozens.

Erin Allmann Updyke

Dang.

Erin Welsh

And the only thing that seemed to be different was the Zika outbreak. But that didn't stop the rumors of course that the cases of paralysis were caused by something else like pesticides for example.

Erin Allmann Updyke

Always blame it on the pesticides.

Erin Welsh

Always.

Erin Allmann Updyke

It's the easiest thing to blame it on.

Erin Welsh

And that's, yeah, I mean sometimes it is pesticides. But that's something that we see pop up time and time again in the history of Zika: rumors. I was trying really hard to work a Fleetwood Mac joke into here but I cannot find anything, I never came up with anything.

Erin Allmann Updyke

You could have just started singing instead. Go on, give it to me. Just a little.

Erin Welsh

Maybe I'll make a fake album cover. Anyway.

Erin Allmann Updyke

Rumors.

Erin Welsh

Rumors. At least in the months after the outbreak it appeared that the only serious possible outcome of infection with the Zika virus was Guillain-Barre. No reports of microcephaly had been made. And as with the Yap outbreak the virus burned through the population, this time only 66% of the population of around 250,000 people was infected.

Erin Allmann Updyke

Oh, only 60% of 250,000. That's fine.

Erin Welsh

Only 66%, yeah. No big deal. NBD.

Erin Allmann Updyke

(laughs) Just a few thousand people, no big deal.

Erin Welsh

Yeah. A handful, really.

Erin Allmann Updyke

Really.

Erin Welsh

And then it seemed to disappear. And following this large scale outbreak, Zika showed up on other islands in the Pacific throughout 2014 including Rapa Nui also known as Easter Island and the Cook Islands. But these outbreaks didn't get as many headlines as the one on Yap and in French Polynesia largely because the population wasn't as big and also probably because Zika still wasn't considered much of a threat. The next time Zika would make front page news it would do so in a big, big way. In an international way. And it would stay there for months if not years.

Erin Allmann Updyke

Yeah.

Erin Welsh

Let's continue our journey across the Pacific, jumping across South America and landing all the way over on the Atlantic coast of Brazil, May 2015.

Erin Allmann Updyke

Yes.

Erin Welsh

Where a Zika epidemic was raging. Although later molecular tests would show that the virus had been circulating in Brazil at least since 2014, the epidemic wasn't recognized until May 2015, probably for many reasons including mosquito population dynamics and the natural epidemic growth of this population. During the middle of the Brazil outbreak there was a lot of discussion as to where did this come from, where did this come from?

Erin Allmann Updyke

Yeah.

Erin Welsh

When it could've been a lot of different sources but it seems likely that it came over at some point during something called the Va'a World Sprints.

Erin Allmann Updyke

Okay.

Erin Welsh Which is this outrigger canoe races held in Rio in August 2014. And so this was a month after the World Cup that had many participants from the Pacific Islands where there had been cases of Zika. So another theory is that it was introduced during the FIFA Confederations Cup which is the pre-World Cup match thing that was played in-

Erin Allmann Updyke (laughs) Match thing.

Erin Welsh Yeah I don't know.

Erin Allmann Updyke Some like big time football people are gonna be like. 'It's not a match thing, Erin!'

Erin Welsh Listen it can be a match thing if I want it to be a match thing. (laughs)

Erin Allmann Updyke Obviously not sports fanatics over here.

Erin Welsh But that match thing was played in June 2013 and so that would mark a slightly earlier origin.

Erin Allmann Updyke Oh. Yeah. Would that also be even earlier than the French Polynesia outbreak?

Erin Welsh It would but there have also been indications that the virus was present in Haiti and some other Caribbean islands before or at least at the same time as the French Polynesia.

Erin Allmann Updyke Huh, interesting.

Erin Welsh So up to this point we had seen how the virus could act on relatively small islands but how would it behave when it got to a country with some very high population densities and then spread to the rest of the continent? Because mosquitoes don't exactly acknowledge political boundaries. At first the epidemic mirrored that of Yap in French Polynesia, mostly mild infections with very few people needing hospitalization and a heightened incidence of Guillain-Barre. But this epidemic was different than those other ones in a couple of key ways, one expected and the other a complete surprise. First, Zika didn't burn through the population like it did in the island outbreaks but rather established more of a permanent transmission zone which was somewhat expected given that the much larger population meant a constant supply of susceptible people and a much, much larger geographic area meant more places to spread. And at this point you can probably guess what the surprise difference was in this outbreak because there's one essential thing about Zika that has been conspicuously absent from the history so far.

Erin Allmann Updyke Microcephaly.

Erin Welsh You got it.

Erin Allmann Updyke Yeah.

Erin Welsh
In October 2015, 5 months after a Zika epidemic had been confirmed, doctors in the northeastern city of Recife noticed that they were delivering an unusually high number of infants with microcephaly. And a few of these doctors suggested that there was a link between the Zika virus and microcephaly based purely on the shared epidemiological patterns of the two. Both Zika and microcephaly were highest in the northeastern part of Brazil and the delay between the Zika outbreak and the microcephaly made sense given a prenatal exposure. And in November of 2015 Brazil declared a state of emergency as the number of diagnoses of microcephaly climbed past 2700. Some obstetricians and even public health officials were advising women not to get pregnant which was unheard of.

Erin Allmann Updyke
Yeah.

Erin Welsh
And it shows how dramatic the uptick in microcephaly was during this time and also serves as a bit of a preview for the many debates that would be held on the international stage about Zika, its effects, and recommendations for those in endemic areas. At the time when the state of emergency was declared, there was as of yet no definite pathophysiological evidence, no lab studies on animal models, no meta-analysis that clearly demonstrates the link between microcephaly and Zika which naturally led to speculation. And I'm sure you remember some of the other rumors about what was causing the increase in microcephaly.

Erin Allmann Updyke
Yeah.

Erin Welsh
Genetically modified mosquitoes to fight dengue, chemical larvicide in drinking water that was intended to kill mosquito larvae.

Erin Allmann Updyke
Yeah.

Erin Welsh
The rubella vaccine.

Erin Allmann Updyke
Ooh, I didn't hear that one.

Erin Welsh
Yeah because apparently rubella can cause microcephaly.

Erin Allmann Updyke
Yeah it can cause a lot of fetal defects if a pregnant woman gets infected but also pregnant women don't receive the MMR vaccine which contains rubella because it's a live vaccine, so.

Erin Welsh
Well we've never known anti-vaxxers to be logical or fact-based in any of their-

Erin Allmann Updyke
Right, sorry. My B.

Erin Welsh
Another one was that there was no actual increase in microcephaly cases at all but that Brazil hadn't been keeping track of the cases well or they had changed the definition so that a larger skull circumference would be classified as microcephalic. Side note, it was actually the reverse. So the upper limit of what was considered microcephaly had actually been decreased.

Erin Allmann Updyke
Ooh.

Erin Welsh
Yeah. But for most of the cases that were microcephaly as a result of Zika, they were not on the borderline.

Erin Allmann Updyke
Right.

Erin Welsh: So it wouldn't have mattered.

Erin Allmann Updyke: Yeah.

Erin Welsh: And then there was the apparent absence of microcephaly outbreaks in places where Zika was endemic such as parts of Africa and Asia. But that could be explained by early exposure and subsequent lifetime immunity which also explains why we hadn't really seen a big outbreak, it probably has just been there circulating for a long time. It seemed like every time one rumor was discounted another popped up into its place. I remember these rumors making the rounds during late 2015 and early 2016.

Erin Allmann Updyke: Yeah.

Erin Welsh: None of them calling themselves rumors of course, more like 'Could Frankenmosquitoes be responsible for the increase in microcephaly?'

Erin Allmann Updyke: Like BuzzFeed headlines kind of thing.

Erin Welsh: Right. And then the article that goes with the headline just wildly speculates and it's not actually asking that question, it's more like, 'Frankenmosquitoes could be responsible.' You know? And it takes phrases like 'could indicate' as 'yes, definitely, it does this'.

Erin Allmann Updyke: Right.

Erin Welsh: And this is where the very real disconnect between how science is written about for academic journals and how science is written about for newspapers becomes very apparent.

Erin Allmann Updyke: Oh god, yeah.

Erin Welsh: For instance if there is a paper in a scientific journal that said, 'This finding is highly suggestive of a causative link between Zika and microcephaly,' that might sound fairly uncertain or at least more uncertain compared to 'Zika causes microcephaly'.

Erin Allmann Updyke: I just feel like what you said sounded so certain, I was like wow, were there papers that said that back then? Cause to me that sounds like really...

Erin Welsh: Right.

Erin Allmann Updyke: But that's because I read scientific papers, so.

Erin Welsh: You read these papers and it is, I mean all of the wording is incredibly cautious because that's how science is done.

Erin Allmann Updyke: Yeah.

Erin Welsh

Very, very rarely is anything ever proven. Instead hypotheses are supported. Every now and then, rarely, a theory will be developed and that's about the closest thing we have to anything being proven. And this is one of the reasons that the link between Zika and microcephaly seemed to take a while to become fully established. There cannot be jumping to conclusions. Each piece of evidence has to be carefully measured and weighed, especially when lives are on the line. All things considered, the link between Zika and microcephaly took not very long at all to be established thanks in part to a policy of freely publishing data that many researchers took part in as well as a pledge to make Zika articles freely accessible during the duration of the emergency. On February 1, 2016 the WHO declared a public health emergency of international concern over the possibility that Zika caused microcephaly which was very carefully worded. The possibility.

But not more than 2 months later the wording of the WHO's Zika report changed to, quote: "Based on observational, cohort, and case control studies there is strong scientific consensus that Zika virus is a cause of GBS, microcephaly, and other neurological disorders." GBS means Guillain-Barre. Scientists looked back at places that had Zika outbreaks before like French Polynesia and Yap and found clusters of microcephaly. They did lab experiments showing that the virus injected into a mouse at any stage of pregnancy could be deadly to the fetus and they had case control studies in which they followed women who had tested positive for Zika infection during pregnancy through the time they'd given birth. There was no one study that showed this definitive link, it was many small ones cause that's how science is done. And this link, like you mentioned, between a mosquito-borne virus and a horrible, horrible neurological disorder was unprecedented in medicine.

If most of the world had had its head turned toward Brazil during late 2015, its eyes were starting to wander in the early months of 2016 as the virus made its way throughout other parts of South America and up through Central America. Even before the link between Zika and microcephaly had been established, even before the WHO had declared its first global emergency, countries were issuing travel advisories for its citizens. 'If you are pregnant or thinking of becoming pregnant you shouldn't travel to X or Y country where there is an ongoing outbreak of Zika.' And as the sexual transmission aspect of Zika became apparent, that was incorporated into the warning. It became more wide, it wasn't just towards pregnant women, it was also about if you have been to a country you should consider this and etc.

Erin Allmann Updyke

Yeah, you should use safe sex practices and blah, blah, blah.

Erin Welsh

Yeah. Of course there was a lot of fear about bringing the virus to the U.S. because the mosquito vector is present there but what about warnings or advice for the people living in those epidemic regions? What should they be told about Zika? As I mentioned earlier, some public health officials and physicians were advising their patients to wait to get pregnant but there had been no formal statement to that effect from governments early on. And should there be? This was a big debate among reproductive health and infectious disease specialists and was reported to be causing quite a rift within organizations like the CDC.

What role, what right does the government have to make these recommendations to women about what they should or shouldn't do with their bodies and when? Access to birth control wasn't possible for many, in some places most of the women in these countries. For married women in Guatemala, Bolivia, and Haiti, less than 35% of women had access to birth control at the time when this book was written, so 2016. Other places fared barely better. 50%, 60%. And what about women who can't delay pregnancy by a couple of years due to biological reasons?

Erin Allmann Updyke

Or they just don't want to.

Erin Welsh

Or they don't want to, yeah. What about the dark history of forced birth control that has lingered in some places? Sterilization programs for convicted people. Ultimately most countries didn't recommend waiting to get pregnant although some did, said 'Wait 2 years, wait 6 months.' Whatever.

Erin Allmann Updyke

Yeah.

Erin Welsh

Most instead recommended protective measures such as mosquito nets, bug spray, and screens. But this brought to light the really important issue of access that I in reading this book didn't feel like it got enough attention or coverage. Access to accurate information, access to healthcare, access to birth control, access to these protective bug nets.

Erin Allmann Updyke

Yeah.

Erin Welsh

These mosquito sprays.

Erin Allmann Updyke

Yeah.

Erin Welsh

Access to the things that would allow you to protect yourself and your family and to make an informed decision.

Erin Allmann Updyke

Yeah. I remember when they were talking about making those recommendations and in some areas just telling women, 'You can't get pregnant. Don't get pregnant.' And just being so infuriated at that idea because it is often so difficult to get birth control. I mean even in the U.S. it's often very difficult to get birth control, you know.

Erin Welsh

Yeah.

Erin Allmann Updyke

So it was just so infuriating.

Erin Welsh

Even if these recommendations had been made, because even if it was just these governments saying you should wait to get pregnant, then it's almost like they're washing their hands of this.

Erin Allmann Updyke

Yeah! Right.

Erin Welsh

Because it's like well then if you got pregnant you went against our recommendations so there's nothing we can do for you instead of the fact that it's like well it wasn't exactly a choice for me, perhaps. You know? All of these different aspects.

Erin Allmann Updyke

Yeah.

Erin Welsh

Amidst these debates, Zika was continuing to spread and spread and spread. And panic reached an all-time high during the lead up to the 2016 Olympics in Rio.

Erin Allmann Updyke

Yep.

Erin Welsh

And the final tally of cases of Zika and cases of microcephaly reported for those attending the games was 0.

Erin Allmann Updyke

Huh.

Erin Welsh: Yeah, so 0.

Erin Allmann Updyke: That was very anticlimactic. Great though.

Erin Welsh: Well make no mistake, Zika was still an ongoing problem in Rio during this time, particularly in poor areas with little infrastructure and no access to healthcare.

Erin Allmann Updyke: Just not amongst people who were at the Olympics.

Erin Welsh: Who could afford to travel to the Olympics and spray themselves with bug spray or whatever else.

Erin Allmann Updyke: Right.

Erin Welsh: I think that this so far in our podcast is the closest that history has gotten to the epidemiology.

Erin Allmann Updyke: Yes!

Erin Welsh: So I feel like we should just jump straight into it.

Erin Allmann Updyke: Okay.

Erin Welsh: Erin, tell me about Zika now. Is there a vaccine?

Erin Allmann Updyke: Let's do it.

TPWKY: (transition theme)

Erin Allmann Updyke: Okay. PAHO, which is the Pan American Health Organization, from 2015 all the way through 2017 had lists that were updated several times a month of the cumulative case reports from every country across the Americas that included the number of autochthonous cases - that's a new vocab word.

Erin Welsh: I love that word too.

Erin Allmann Updyke: It's such a good word. Autochthonous. Erin, tell us what it means.

Erin Welsh: Basically it means - are you asking me or are you asking you?

Erin Allmann Updyke: Oh, good question. I'm asking you. (laughs)

Erin Welsh: (laughs) I know sometimes you talk to yourself, so.

Erin Allmann Updyke: I do.

Erin Welsh: Basically it means 'arising from the same location'.

Erin Allmann Updyke: Exactly, yeah. So autochthonous cases of transmission in the U.S. are cases that weren't imported from somewhere else, they're cases that were transmitted in the U.S. So the number of autochthonous as well as the number of imported cases. But what I find gobsmacking about the PAHO-

Erin Welsh: Ooh!

Erin Allmann Updyke: Good word.

Erin Welsh: Great word.

Erin Allmann Updyke: The most recent update that PAHO has about the number of cumulative cases of Zika virus was last updated January 4, 2018.

Erin Welsh: So a year and some change.

Erin Allmann Updyke: A year ago. We'll see if this changes by the time we release this episode but as of recording, the data that I have is from one year ago.

Erin Welsh: Okay.

Erin Allmann Updyke: So as of January 2018, the countries that have been hardest hit by far in terms of the total number of cases are Brazil and Puerto Rico. Over 137,000 total cases in Brazil and over 40,000 in Puerto Rico. And that's just confirmed cases, that doesn't include many, many more suspected cases.

Erin Welsh: Is that number total or is that just for 2016/2017 or 2017/2018?

Erin Allmann Updyke: That's 2016/2017. So we don't have numbers from 2018 yet.

Erin Welsh: Okay.

Erin Allmann Updyke: And what's also important to point out and I do wanna make this important cause it's important in epidemiology in general but it's super important in this case is that those are the largest number of cases overall. So while Brazil had the largest number of cases, it's a massive country, right. So in epidemiology we don't really look at raw numbers that often, we usually use incidence rate rather than straight numbers to get a sense of how many people are affected based on the population size. So we look at the number of cases per 100,000 people.

Erin Welsh: Yeah.

Erin Allmann Updyke: So in that case it's actually some of the Caribbean islands, for example Curacao which had over 2000 confirmed cases but the incidence rate is over 4000 cases per 100,000 people.

Erin Welsh: Oh my gosh.

Erin Allmann Updyke: And in Brazil the case rate is still extremely high, 176 cases per 100,000 people in Brazil.

Erin Welsh: Wow.

Erin Allmann Updyke: Yeah.

Erin Welsh: That's really high.

Erin Allmann Updyke: It's really high. Puerto Rico, the incidence rate was over 1000 cases per 100,000 people from 2016-2017.

Erin Welsh: Oh my god.

Erin Allmann Updyke: So for comparison in the U.S. in that time period there were 227 confirmed autochthonous transmission cases. That means people who acquired Zika infection in the United States, 227. That's a incidence rate of 0.06 cases per 100,000 people. So overall across all the countries in the Americas that have been affected, there have been over 223,000 confirmed cases and 580,000 suspected cases.

Erin Welsh: Wow.

Erin Allmann Updyke: As well as 3720 cases of confirmed congenital Zika syndrome. Yeah. It only had 20 deaths listed but I'm not sure that that counts fetal deaths or early pregnancy loss. I don't believe that it does but I'm not positive.

Erin Welsh: Okay.

Erin Allmann Updyke: And I will say that this is not the only place that Zika is happening. So I actually was checking ProMED and there was an outbreak of Zika going on in India very recently.

Erin Welsh: Okay and do we know what strain that is or...?

Erin Allmann Updyke: I have absolutely no idea cause I didn't go further down that rabbit hole. (laughs) It's a great question though. Okay so now the question is what are we doing about it? Now that Zika is on everybody's radar we should have a vaccine for it, right, just like after the Ebola outbreak we had a vaccine, right? Right? Right?

Erin Welsh: Oh yeah.

Erin Allmann Updyke: No.

Erin Welsh: Well we do now, though.

Erin Allmann Updyke: Well let's talk about why. So one of the things I think that I was so excited to talk about Zika virus is that it's such a beautiful example of a disease that we have known about for 70 years, that's a long time, and yet we know so little about this disease.

Erin Welsh: Yeah.

Erin Allmann Updyke: One of the reasons is in our scurvy episode you touched briefly on the idea of developing animal models, right, which is a really important part of studying diseases that infect humans. And I don't remember the exact year that you said the guy came up with the guinea pig as the model.

Erin Welsh 1893!

Erin Allmann Updyke Thank you! Was it really?

Erin Welsh No, I have no idea.

Erin Allmann Updyke (laughs) But it was a long time ago, right?

Erin Welsh Yeah.

Erin Allmann Updyke It was a very long time ago. And that's what allowed us to hone in on and figure out what exactly was happening with scurvy. Well with Zika it's not that we didn't have any animal models, it's not that they didn't exist at all but two things: one, very few good animal models actually did exist, and number two, the ones that did exist were made from very, very old strains like the 1947 first discovered strain of Zika virus. And viruses evolve, they change. So it's important to have animal models that actually reflect the viruses that are circulating in the population. And it has only been in the last 3 or 4 years that you can find a ton of papers where people are literally developing animal models to study Zika.

Erin Welsh Wow.

Erin Allmann Updyke It is so cool.

Erin Welsh Is there a candidate animal model now?

Erin Allmann Updyke There are several and so I'll post some of those. There's actually a really nice review that goes through all of the research that's been done currently and what the most promising animal models are. And so mostly it's mice and nonhuman primates. So those are the two biggest ones.

Erin Welsh Makes sense.

Erin Allmann Updyke Right? They're just kind of some of the biggest in general. But what's really important is developing this nonhuman primate model though because the effects of Zika, like mouse placentas aren't equivalent to human placentas and mouse fetal development is nothing like, well not nothing like, but very dissimilar to human fetal development. So developing these nonhuman primate models in order to study the effects of Zika on fetuses is really, really important.

Erin Welsh Right.

Erin Allmann Updyke And so they've done a lot of that. They've infected pregnant monkeys with Zika and found their fetuses to have reduced growth of the fetal brain, white matter deficiency, axonal damage which means damage to the axons which are like the long spindly bits of your neurons, and more. And they've been able to detect Zika virus in all different kinds of placental tissue and fetal tissue.

Erin Welsh Wow.

Erin Allmann Updyke: Yeah so these links are very clear even though we don't know the exact pathophysiology of how exactly is Zika infecting this cell and then what is it doing within that cell? We know that it's infecting the fetus, it's infecting the fetus brain, and it's causing this damage. And development of these animal models allows us to get a better understanding not just of that pathophysiology so that someday we will know exactly how it's causing disease, we can also study the mechanisms by which it's able to be sexually transmitted.

Erin Welsh: Yeah.

Erin Allmann Updyke: We can study the mechanisms by which it can cause Guillain-Barre. This also allows for the study of antibody therapy, antiviral therapy, and vaccine development.

Erin Welsh: Aha!

Erin Allmann Updyke: So let's talk about it. There are vaccines in development including at least several DNA vaccines. (trumpeting sound)

Erin Welsh: Oh, my fave.

Erin Allmann Updyke: Your fave. However it's many, many years away before we'll see any real action from that most likely.

Erin Welsh: That makes sense.

Erin Allmann Updyke: It makes sense because prior to these most recent outbreaks nobody was paying attention to Zika.

Erin Welsh: Which also makes sense, I mean it was a very mild infection that no one knew had this up its sleeve.

Erin Allmann Updyke: It does! Right. So I think an important contrast to make here is that with Ebola, before the 2014 outbreak, there had been a lot of funding to study Ebola and there had been vaccines that were in development but funding for those had often dried up. And so while they had been started down the long road of vaccine development, they hadn't made it all the way. With Zika people had been starting completely from scratch. So the World Health Organization has a pretty awesome actually, I can't believe I just found out about this, they have a vaccine development tracker and I'll definitely put a link to it on our website. But on this you can see the status of vaccine development for a whole number of different diseases including Zika virus. So there are - yeah, it's very cool. There are a lot of different groups that are working on it and you can see exactly what phase they're in. So at this point basically all of the Zika vaccines are in phase 1 trials, there's two that are in phase 2 trials.

Erin Welsh: Okay.

Erin Allmann Updyke: Phase 1 is essentially just making sure that this vaccine is safe and not going to kill people or maim them.

Erin Welsh: Important.

Erin Allmann Updyke: It's really important. You just give the vaccine to a small number of people, probably in various dosages, and you're just trying to make sure that it doesn't make anybody sick or cause any serious adverse reactions. Phase 2 is when you actually try and see if it works which is harder to do, it's not testing it against anything else, that's phase 3 where you have controls, right.

Erin Welsh: Yeah.

Erin Allmann Updyke: So it's just trying to see if it's effective at all. And this is hard for vaccines in general but it's really hard for diseases that have low incidence because if you're never exposed to a disease, you can really, really test if it works. But we also can't give people diseases, that's not ethical. So what you can do is test for an immune response.

Erin Welsh: Right.

Erin Allmann Updyke: So you can give people a vaccine and then you can test their blood after a certain period of time to make sure that they're actually making antibodies against the vaccine components.

Erin Welsh: Cool.

Erin Allmann Updyke: So that's the stage that two of the vaccines are in but most of them are still just in phase 1 where they're just trying to make sure that their vaccines don't kill anybody. And that's what's happening with Zika research.

Erin Welsh: That's pretty cool.

Erin Allmann Updyke: It's pretty cool, it's been very quickly added to the WHO's list of priority diseases, so yeah. It's an I think probably very exciting time to work in the Zika field.

Erin Welsh: Yeah I can imagine. I have a question.

Erin Allmann Updyke: Okay.

Erin Welsh: Only 5-15% of women who are infected with Zika while pregnant have an adverse outcome.

Erin Allmann Updyke: Right.

Erin Welsh: Are there any other outcomes associated with the 95-85% of women who are not? So something like are there developmental disorders in otherwise physically healthy children, are there anything that's diagnosed at a higher rate, anything like that?

Erin Allmann Updyke: It's a good question and I don't think that we know yet at this point because remember that since the first time that we found out that even microcephaly was a thing associated with Zika was just 2 years ago.

Erin Welsh: But some of those kids presumably from like the Yap outbreak or the French Polynesia would be...

Erin Allmann Updyke Right, but that would mean that people would have to be doing studies on those people now and I don't know that they are. So I would guess that... I know that in Brazil there are definitely longitudinal studies that are being done and are probably following up on those exact outcomes but I don't know if people have looked back to see in older kids if there's any other effects, I'm not sure.

Erin Welsh Yeah.

Erin Allmann Updyke It's a really good question though cause it definitely seems possible.

Erin Welsh Right.

Erin Allmann Updyke Yeah. That's Zika.

Erin Welsh Wow.

Erin Allmann Updyke It's a scarier one than I gave it credit for when I first heard about it, that's for sure.

Erin Welsh Oh yeah, it's a scary one, it's a sad one, and it's definitely present tense, future tense verbs apply here.

Erin Allmann Updyke Yeah, absolutely. It will be very interesting I think to see if there is continued cases and continued sort of epidemics of microcephaly in the Americas or if this becomes like it perhaps was in Africa just sort of an endemic disease that people get exposed to in childhood and then we no longer see it as affecting pregnant women because women have been exposed to it when they're younger. It's gonna be really interesting to follow Zika over the next few decades.

Erin Welsh Yeah, absolutely.

Erin Allmann Updyke Yeah. Sources?

Erin Welsh Yeah. I have some papers that I will put on the website and I also, as I mentioned earlier, the book 'Zika' by Donald McNeil which was written in 2016 before the Olympics, right on the heels of the big Brazil outbreak.

Erin Allmann Updyke Cool. I have a number of articles, the one I do wanna shout out that I thought was super interesting was by Thomas Morrison and Michael Diamond that is a summary of animal models. We will as always link to all of the articles and books that we used in this episode on our website, that's thispodcastwillkillyou.com/episodes. So you can find all of our sources from every episode there. And...?

Erin Welsh And thanks to Bloodmobile for providing the music for this episode and all of our episodes.

Erin Allmann Updyke Love ya. And thank you dearest listeners for listening to our ramblings.

Erin Welsh Dearest, dearest listeners.

Erin Allmann Updyke We love you.

Erin Welsh Yes, we do.

Erin Allmann Updyke

It's the best.

Erin Welsh

It is. Okay, until next time, wash your hands.

Erin Allmann Updyke

Ya filthy animals!