

TPWKY

This is Exactly Right.

Erin Welsh

"The red areas spread into blotches across the face and arms and within hours the blotches broke out into seas of tiny pimples. They were sharp-feeling, not itchy, and by nightfall they covered the face, arms, hands, and feet. Pimples were rising out of the soles of the feet and on the palms of the hands, too. During the night the pimples developed tiny blistered heads and the heads continued to grow larger, rising all over the body at the same speed, like a field of barley sprouting after the rain. They hurt dreadfully and they were enlarging into boils. They had a waxy, hard look and they seemed unripe. Fever soared abruptly and began to rage. The rubbing of pajamas on the skin felt like a roasting fire. By dawn, the body had become a mass of knob-like blisters. They were everywhere, all over, but clustered most thickly on the face and extremities.

The inside of the mouth and ear canals and sinuses had pustulated. It felt as if the skin was pulling off of the body, that it would split and rupture. The blisters were hard and dry and they didn't leak, they were like ball bearings embedded in the skin with a soft, velvety-feel on the surface. Each pustule had a dimple in the center. They were pressurized with an opalescent pus. The pustules began to touch one another, and finally they merged into confluent shapes that covered the body like a cobblestone street. The skin was torn away across the body and the pustules on the face combined into a bubbled mass filled with fluid, until the skin of the face essentially detached from its under layers and became a bag surrounding the tissues of the head. Tongue, gums, and hard palate were studded with pustules, the mouth dry. The virus had stripped the skin off the body, both inside and out. And the pain seemed almost beyond the capacity of human nature to endure."

Erin Allmann Updyke

Oh my god. (laughs)

Erin Welsh

(laughs)

Erin Allmann Updyke

Hi.

Erin Welsh

Hi.

Erin Allmann Updyke

Welcome to Episode 3 of This Podcast Will Kill You.

Erin Welsh

This week we're talking about smallpox.

Erin Allmann Updyke

Clearly. That was smallpox.

Erin Welsh

Yeah, it's horrifying.

Erin Allmann Updyke

Oh my god. (laughs)

Erin Welsh

And that quote was from 'The Demon in the Freezer' by Richard Preston.

Erin Allmann Updyke

Wow.

Erin Welsh

So how about a little something to take the edge off?

Erin Allmann Updyke

Yeah, let's take that edge off.

Erin Welsh: What are we drinking this week?

Erin Allmann Updyke: Today we're drinking 'Smallpox on the Rocks'. (laughs) That's gross.

Erin Welsh: (laughs) Yeah. I don't know if I want to drink that anymore.

Erin Allmann Updyke: You know, it takes the edge off, so...

Erin Welsh: Sure, sure, sure. What's in Smallpox on the Rocks?

Erin Allmann Updyke: Basically it's a whiskey sour. So that's pretty straight forward.

Erin Welsh: Sign me up. I'm already signed up.

Erin Allmann Updyke: (laughs) If you'd like to drink along at home, you can make your own Smallpox on the Rocks by mixing 2 oz of your favorite whiskey-

Erin Welsh: Woodford Reserve.

Erin Allmann Updyke: That's the Kentuckians.

Erin Welsh: That's my plug.

Erin Allmann Updyke: She would know, you know. Like, she does know.

Erin Welsh: Rye is good too, but let's go with bourbon.

Erin Allmann Updyke: And the juice of half a lemon, which is literally every recipe. And I looked it up, it's about 3 tablespoons of lemon juice. That's the juice of half a lemon.

Erin Welsh: No, that's the juice of a whole lemon.

Erin Allmann Updyke: Oh, you're right! So it's 1 1/2 tablespoons of lemon juice. (laughs)

Erin Welsh: I mean, maybe more is better! We did it 1 1/2 tablespoons per 2-

Erin Allmann Updyke: Oz of-

Erin Welsh: Bourbon.

Erin Allmann Updyke: And about 1/2 teaspoon of sugar. Shake it up over ice, drink it on the rocks. Cheers!

Erin Welsh: Cheers. (clinking)

Erin Allmann Updyke: I wonder what that sounded like.

Erin Welsh: I don't know, I hope it was good.

Erin Allmann Updyke: Me too. We need better clinky glasses.

Erin Welsh: Yeah.

TPWKY: (transition theme)

Erin Allmann Updyke: Let's define a few words for this week. What are the words that we're gonna be defining this week?

Erin Welsh: Let's start with 'endemic'.

Erin Allmann Updyke: So in terms of disease, endemic is a disease that is regularly found among a particular people or in a certain area. So for example, there are certain areas of the world where malaria is considered endemic and if you see malaria in those areas that's sort of normal. Whereas if you were to see malaria outside of those areas, that would be considered an epidemic or an outbreak.

Erin Welsh: Gotcha. All right. Next one is 'bioterrorism'.

Erin Allmann Updyke: Bioterrorism is pretty straight forward, it's essentially just terrorism that includes the release of a biological, toxic agent. That's it.

Erin Welsh: Clear. Clear to me.

Erin Allmann Updyke: Clear as day.

Erin Welsh: Let's talk about what a 'reservoir' is.

Erin Allmann Updyke: So a reservoir for disease is a long-term host of a pathogen that often do not show symptoms or have sort of subclinical infections. So in leprosy we talked about armadillos. Armadillos are reservoirs for the leprosy bacteria.

Erin Welsh: Eradication'.

Erin Allmann Updyke: Eradication is a fun one.

Erin Welsh: Yeah, it's a happy one.

Erin Allmann Updyke: It's a happy one. So eradication of a disease, according to the CDC, is the "permanent reduction to zero of worldwide incidents of infection caused by a specific agent that is the result of deliberate efforts" in order to eradicate that disease, to the point where "intervention measures are no longer needed" to control that disease.

Erin Allmann Updyke: There are two diseases in the world that have been eradicated. Erin, what are those diseases?

Erin Welsh: Oh. (clears throat) Smallpox, the topic of today. And actually the other one, which you may not have heard of, it's called Rinderpest and it is a disease of cattle, both domestic and wild. So ungulates.

Erin Allmann Updyke: Ungulates.

Erin Welsh: And they're both gone, so that's awesome.

Erin Allmann Updyke: Cool! Go humans!

Erin Welsh: And hopefully soon polio, guinea-worm, some of the other diseases will also be on that list thanks to the Carter Foundation. Right? Is it the Carter Foundation?

Erin Allmann Updyke: I don't know.

Erin Welsh: It's Jimmy Carter.

Erin Allmann Updyke: Cool.

Erin Welsh: Jimmy Carter's doing a lot of work for eradication, for both of those.

Erin Allmann Updyke: That's awesome.

Erin Welsh: Yeah, he's awesome. Now that we've defined those terms, let's jump into the biology. Erin, tell me all about smallpox.

Erin Allmann Updyke: I'd love to, Erin. (giggles) Okay, so smallpox. This one is a doozy, no lie.

Erin Welsh: I know! I mean, we were already hit pretty hard at the beginning of this episode.

Erin Allmann Updyke: Right? Just starting us off with a bang. So here are the basics. Smallpox is a virus. It's a DNA virus, so if you remember Influenza was an RNA virus, this is a little bit different. It is in a family of viruses known as the pox viruses, and I feel the need to tell you that chickenpox is not a pox virus.

Erin Welsh: That's an important clarification, though.

Erin Allmann Updyke: It really is. Chickenpox is caused by a herpes virus, so it's a totally different family of viruses. But there are a ton of other pox viruses besides smallpox. There are pox viruses that infect basically every vertebrate that you can think of. There is monkeypox, turkeypox, gerbil pox, camelpox, dolphin pox-

Erin Welsh: Erin. Erin.

Erin Allmann Updyke: -penguinpox, snake-

Erin Welsh: Erin.

Erin Allmann Updyke: There is crocodilepox-

Erin Welsh: (laughs)

Erin Allmann Updyke: -kangaroo pox. (laughs)

Erin Welsh: I think we get the point.

Erin Allmann Updyke: Yeah, that literally wasn't even the whole list.

Erin Welsh: What about fish?

Erin Allmann Updyke: Uh, well there's dolphin pox. Dolphins aren't fish, but-

Erin Welsh: Oh my gosh, are you serious? There actually is dolphin pox?

Erin Allmann Updyke: There actually is dolphin pox, that's not a lie. And yeah, reptiles can get various poxes, snake pox, so I think there could be fish pox as well.

Erin Welsh: This is probably a really old family of viruses.

Erin Allmann Updyke: Yes. There are also insect pox viruses. And those are gnarly because insects don't have skin, so they basically turn into a giant ball of pox jelly. It's gnarly. That's not a lie.

Erin Welsh: I wanna google that.

Erin Allmann Updyke: You should.

Erin Welsh: Let's post a picture of an insect infected by some sort of pox virus to Instagram.

Erin Allmann Updyke: Oh, we will. Oh god, it's just gonna be goo. Just goo.

Erin Welsh: Yum.

Erin Allmann Updyke: So smallpox itself has two major forms, variola major and variola minor, that are basically named because major is a major problem, minor was a minor problem. We're not really going to get into the distinction for this episode. Most of what you hear about in terms of the statistics about this disease have to do with variola major.

Erin Welsh: Okay.

Erin Allmann Updyke: Even though there are pox viruses that can infect tons of other vertebrates, smallpox itself is an exclusively human-specific virus. It likely jumped into humans from some type of rodent, we don't know exactly what kind.

Erin Welsh: Really?

Erin Allmann Updyke: Yeah, it's most closely related to a rodent pox virus. And this likely happened around the time of the agricultural revolution, about 10,000 years ago. But estimates really vary on that, it's not exactly clear when this first happened. But the reason that we think it likely was around the agricultural revolution is because math models have shown that this virus needs a really large human population size in order to sustain itself.

Erin Welsh: So, but not just human population size but human population density?

Erin Allmann Updyke: Exactly, exactly, yes. That's right.

Erin Welsh: Okay.

Erin Allmann Updyke: So let's get into the disease itself.

Erin Welsh: Yes!

Erin Allmann Updyke: We've already heard a little bit. It's just going to get worse? Better? I don't know.

Erin Welsh: Probably worse.

Erin Allmann Updyke: Yeah. And also better. I mean it'll get worse and then it will get better.

Erin Welsh: We're not sure where we're gonna end up.

Erin Allmann Updyke: Well, we'll find out. So smallpox has an incubation period, which if you remember from the last episode is the time from when you're exposed to when you show symptoms, is about 12 days. 10-14 days, but 12 days on average.

Erin Welsh: That's a long time.

Erin Allmann Updyke: It's a pretty long time. The one good thing, and I really think this is the only good thing about the smallpox virus, like no joke, is that it does not tend to be infectious until you start showing symptoms. And you are the most infectious, that is you're shedding the most virus when you have some of the more severe symptoms.

Erin Welsh: Which are?

Erin Allmann Updyke: Well let's get into it. The progressions of the disease. So it starts off with fever and body aches and sometimes vomiting. And this is not just a typical fever and body aches, this is you are too sick to carry on with your daily activities. And this generally lasts for about 2-4 days. After that, you'll get a rash and redness that generally starts on the face, especially in your mouth and on your tongue.

Erin Welsh: Oh no.

Erin Allmann Updyke: Yeah. So inside your mouth, you'll get sores that may break open and these sores are literally filled with viral particles.

Erin Welsh: Oh my. So then when somebody is nursing you and being like, 'Oh let me make you feel better' and you turn to them and cough a little bit...

Erin Allmann Updyke: Yeah, so it's important, this is a respiratory virus. So this is shed by breathing, coughing, etc. so yeah, if you're infected all up in your mouth and then you're coughing on the people trying to help you, ba-boom. It's gnarly.

Erin Welsh: Oh my gosh.

Erin Allmann Updyke: So then the rash will spread to your body, to your arms, to your legs. Unlike leprosy this starts sort of in the middle of your body and then spreads outwards. Right.

Erin Welsh: Okay.

Erin Allmann Updyke: This stage generally lasts around 4 days and it is the most contagious part of this infection. Then you start to get these lesions, these sores that are filled with fluid. They can become really firm, and like you described earlier, they get this characteristic dimple in the center. Then you'll move on to the pustular rash and scab stage.

Erin Welsh: Oh, no. Stop, please!

Erin Allmann Updyke: I can't stop. I just can't. This is described as peas under the skin.

Erin Welsh: (gasp) Oh my god.

Erin Allmann Updyke: Right? It's so disgusting. They're sharply raised, they're firm to the touch. This lasts for about 10 days. This is a long infection.

Erin Welsh: 10 days. 10 days of pea pimples!

Erin Allmann Updyke: Yes and after about 5 days they'll start to crust over. And I also want to point out that these sores are literally covering your entire body.

Erin Welsh: Confluent.

Erin Allmann Updyke: You're entire body. Confluent, yeah. All over your body, these scabs. And then eventually they'll begin to scab and they'll fall off. And you continue to be infectious until the last scab has fallen off your body - that's if you survive that long.

Erin Welsh: And not only are you infectious, but your scabs are too.

Erin Allmann Updyke: Exactly. So if you imagine, like, I mean today we have... When was the vacuum invented?

Erin Welsh: The vacuum?

Erin Allmann Updyke: Yeah.

Erin Welsh: Oh gosh, like the early 1900s?

Erin Allmann Updyke: There you go. So imagine that you're cleaning up after your family member who is sick and they're dropping scabs all over the place and then you go to vacuum them up and now you're spewing scab dust into the air and then you breathe it in. That's for real. I just made that up.

Erin Welsh: Or, for instance, blankets.

Erin Allmann Updyke: Yeah. You'll talk a lot about that.

Erin Welsh: Yeah, I'll get into that.

Erin Allmann Updyke: So yeah, that's if the person survives all this, they're contagious for that entire time.

Erin Welsh: And how many people did survive this?

Erin Allmann Updyke: In general, the mortality rate is about 20-40%, usually considered about 30%. So on average, about 1 in 3 people infected with smallpox will die.

Erin Welsh: Oh my god.

Erin Allmann Updyke: Now it gets a little bit worse. (laughs)

Erin Welsh: No! How?

Erin Allmann Updyke: What I just described is the progression of what is called 'ordinary smallpox'.

Erin Welsh: Ordinary.

Erin Allmann Updyke: That's the ordinary version.

Erin Welsh: So that's if you're lucky, this is the baseline.

Erin Allmann Updyke: This is the baseline, exactly. So some people who were vaccinated, this is the good version, would end up with what's called 'modified smallpox' which is basically a less severe form. But a large number of people, not a large number, about 5-10% of cases would be what's called 'malignant'. These have a longer prodrome period, which is the period at the beginning when you just have a fever and a mild rash. So they'd have a longer period of that.

Erin Welsh: So it's not like they would be infectious longer, necessarily?

Erin Allmann Updyke: Not necessarily, no. But then when they started to get a rash, the pustules that they would get were slower growing and they would stay flat rather than being raised and their skin would stay - this is a quote from the CDC - "soft and velvety".

Erin Welsh: Ew. What?

Erin Allmann Updyke: Isn't that yucky?

Erin Welsh: What does velvet skin feel like?

Erin Allmann Updyke: I don't know but it doesn't sound good. I don't think it sounds right.

Erin Welsh: We're feeling our faces.

Erin Allmann Updyke: We're touching our faces.

Erin Welsh: I don't think they're velvety.

Erin Allmann Updyke: I need to put lotion on. (laughs)

Erin Welsh: Yeah, that's the lesson we've learned today.

Erin Allmann Updyke But this form of the disease is almost always fatal. And what's really sad is about 72% of the malignant cases were in children.

Erin Welsh Oh!

Erin Allmann Updyke Yeah. There's a worse one, too. The even worse one-

Erin Welsh How.

Erin Allmann Updyke Yeah, is called 'hemorrhagic smallpox'.

Erin Welsh Oh okay, that's how.

Erin Allmann Updyke Yeah. So 'hemorrhagic' meaning bleeding out, essentially. So instead of just forming these pustules under the skin, you would literally just bleed underneath your skin. You'd bleed into your eyes-

Erin Welsh And your skin would slough off?

Erin Allmann Updyke Your skin would just be like puddles of blood. Like your whole skin. You bleed into your eyes to the point where the whites of your eyes would turn black because they're just full of dried blood. You could even get - this might be getting too gnarly - but you could even get... You're bleeding so much that in your capillaries, blood is clotting as it's leaking out. So you have just blood clots and blood everywhere in your body. And it's described as very thick and very dark. You would bleed out of all of your mucus membranes, out of every orifice.

Erin Welsh Oh! People would turn purple.

Erin Allmann Updyke Yes, exactly.

Erin Welsh Cause there would be so much blood under their skin.

Erin Allmann Updyke Exactly. This is about 2% of cases overall, but somewhere between 3-25% of all fatal cases. So this, as you can imagine, was almost always fatal.

Erin Welsh Do you know anything about why a case would become hemorrhagic versus...?

Erin Allmann Updyke You know, I tried to find information about that and I really couldn't find good explanations.

Erin Welsh I mean it makes sense that there weren't scientific research being done then.

Erin Allmann Updyke Yeah. I don't know if it's immune-related, that's what I would guess but I don't really know. Another thing to make all of this that much worse is that people infected with smallpox, you can imagine that if you're infected with a disease that makes you this sick, you're probably not aware of what's going on because your body is just in overload, but with smallpox you stay weirdly very conscious and aware of everything that's happening to you.

Erin Welsh That would be horrible.

Erin Allmann Updyke I think, isn't that your actual worst nightmare? Like personally?

Erin Welsh: It's one of them. I have a lot of worst nightmares. (laughs)

Erin Allmann Updyke: (laughs) It's gnarly. Gnarly is the word of my... Gnarly is the word I wrote the most in my notes.

Erin Welsh: Gnarly is gonna be said a lot.

Erin Allmann Updyke: Yeah. So that's smallpox in a nutshell.

TPWKY: (transition theme)

Erin Welsh: Okay so now that we have, let's call it a baseline understanding of just how awful this disease can be...

Erin Allmann Updyke: I really, to be honest, did not know just how horrible this disease was until I really started reading about it. It is beyond anything that I could've imagined.

Erin Welsh: It's really scary.

Erin Allmann Updyke: It's terrifying.

Erin Welsh: Let's hear more. Let's hear about how terrifying it was for people throughout history.

Erin Allmann Updyke: Let's learn. I wanna learn it all.

Erin Welsh: So like you said, the smallpox virus probably made the leap from domesticated animals or rodents, as it turns out, about 10,000 years ago - estimates.

Erin Allmann Updyke: Rodents were like... When we domesticated animals, it's like we practically domesticated rodents by accident because they were living in the grains and things that we started storing, so we had huge booms in rodent populations at the same time.

Erin Welsh: Exactly. Scientists aren't exactly sure which animal it came from but it probably originated in the same place, geographically, that agriculture and livestock domestication took off, which is the river valleys of Africa and India. And we actually see our first physical evidence of smallpox from around 1500-1000 BC in Egyptian mummies whose preserved skin shows telltale pockmarks from the disease.

Erin Allmann Updyke: Oh my god!

Erin Welsh: Yeah.

Erin Allmann Updyke: You can see the pockmarks on mummies? On actual mummies?

Erin Welsh: Yeah! We're gonna post a picture.

Erin Allmann Updyke: Oh my god that's so cool!

Erin Welsh: It's really cool.

Erin Allmann Updyke	That's insane.
Erin Welsh	Smallpox is what we refer to as a crowd disease. In order for the virus to successfully establish in a population, there needs to be enough people in close contact with one another so that it can be transmitted and maintained, otherwise it'll just blow through a population or village and die out.
Erin Allmann Updyke	Right, cause it just kills people like (snap). Ooh, I hope that snap got-
Erin Welsh	That sounded good, yeah. So it's no coincidence that smallpox started spreading globally just as human population size took off, thanks to farming. From India and Northern Africa it spread east and west to China, Greece, Rome, etc. Around 100 AD, smallpox caused a devastating epidemic in the Roman Empire and this epidemic was called the Plague of Antoninus.
Erin Allmann Updyke	Ooh!
Erin Welsh	Yeah. Like with the 1918 flu pandemic, soldiers returning home were probably responsible for facilitating the spread of the smallpox virus.
Erin Allmann Updyke	Always them soldiers.
Erin Welsh	And at the height of this particular epidemic, 2000 people died daily in Rome.
Erin Allmann Updyke	Oh my...wow!
Erin Welsh	Yeah, that's real bad.
Erin Allmann Updyke	I feel like there wasn't that many people in Rome to die.
Erin Welsh	Well that's the thing, some historians actually suggest that smallpox along with malaria contributed to the fall of the Roman Empire.
Erin Allmann Updyke	I love information like that.
Erin Welsh	I know because no one really talks about the role of infectious disease in history. Or they do but I feel like it's not as-
Erin Allmann Updyke	It's not as big of a deal as like, 'and then the 300 people came and they knocked people down' or whatever.
Erin Welsh	And then the war, yeah. We're gonna talk about it.
Erin Allmann Updyke	It all comes back to infectious disease, people. That's the point of what we're trying to teach you here.
Erin Welsh	It is. After wreaking havoc in Rome, smallpox made its way to the rest of Europe, probably through the Huns or returning crusaders. Around the 12th and 13th century were the crusaders.
Erin Allmann Updyke	Okay, I was gonna say I don't know when that was.

Erin Welsh	I know I had to look it up. I'm like, yeah, crusaders, sure.
Erin Allmann Updyke	That was a time that happened.
Erin Welsh	Well in either case, as global population continued to grow, smallpox epidemics grew more frequent and more intense and in many areas it became endemic.
Erin Allmann Updyke	(gasp) Endemic!
Erin Welsh	There's our word. Call back. More of a childhood illness.
Erin Allmann Updyke	Okay. Uh oh.
Erin Welsh	Let's talk about - yeah.
Erin Allmann Updyke	Your face got real serious. (laughs)
Erin Welsh	It got real serious because here comes one of the most, for me, classic smallpox periods of history.
Erin Allmann Updyke	Yep.
Erin Welsh	One of the things that history teachers, in high school at least, tend to gloss over here in the U. S. is the devastating impact that smallpox and other old world diseases had on the native North and South American populations.
Erin Allmann Updyke	Aw, this is where it gets really depressing.
Erin Welsh	Yeah it's gonna be that way for a while.
Erin Allmann Updyke	Yeah.
Erin Welsh	Yeah, buckle up.
Erin Allmann Updyke	I'm buckled. Oh wait, let me have another sip of my drink.
Erin Welsh	Just drink up. (laughs) Here's the time, bottoms up. It's not yet, it's just gonna get worse.
	Your history teacher may have forgotten to tell you how smallpox blankets were given to Native Americans intentionally by invading Europeans in an often successful attempt to deliberately infect them with this devastating disease.
Erin Allmann Updyke	Like smallpox blankets as in some white dude was like, 'Hey yo, I got a blanket, I'm gonna rub it all around a person with smallpox and then I'm going to give it'... That means that they knew enough to know that this disease was transmitted - ugh.
Erin Welsh	You sound like you want a direct quote.

Erin Allmann Updyke	I do, thank you. (laughs)
Erin Welsh	I'm happy to provide. "In the war of 1763 between England and France for control of North America, British troops were asked: "Could it not be contrived to send the smallpox among those disaffected tribes of Indians? We must on this occasion use every stratagem in our power to reduce them." That's a direct quote and wait a second, it's not done yet because there was a return letter from the ranking British officer who said, quote: "I will try to inoculate the Indians with some blankets that may fall into their hands and take care not to get the disease myself."
Erin Allmann Updyke	What the...
Erin Welsh	That really happened. Even in the instances when it's not entirely clear how deliberately smallpox was spread, like whether it was deliberate or not-
Erin Allmann Updyke	Sounds pretty deliberate, I mean.
Erin Welsh	Well yeah, for instance that case is certainly deliberate. But still Europeans definitely used smallpox to their advantage.
Erin Allmann Updyke	Yeah.
Erin Welsh	Take, for instance-
Erin Allmann Updyke	Oh no.
Erin Welsh	-Spanish conquistador Hernan Cortes. He, along with around 600 men or so, landed in the Yucatan peninsula around 1521 and headed to the Aztec capital city of Tenochtitlan, which is now Mexico City, to try to take over the Aztec Empire. He and his fellow conquistadors were soundly defeated in their first fight with the Aztecs and they expected to lose again when the inevitable second blow would come. But it never came. More than a little confused and apprehensive-
Erin Allmann Updyke	Yeah?
Erin Welsh	That's what I wrote. And tired of waiting, the Spanish stormed the city. Once inside they found that smallpox had devastated the city.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Cortes and his men had probably all been exposed to smallpox as children and so the disease didn't affect them. Seeing this furthered the belief among the Aztecs that the invading Spanish were gods. A belief that the Spanish did nothing to discourage.
Erin Allmann Updyke	Wow, that's so sad.

Erin Welsh: It is. And that is how Cortes and his band of around 500-600 conquistadors toppled the 25 million people-strong Aztec Empire. That was it, that was the end of the Aztec Empire, for all intents and purposes.

Erin Allmann Updyke: Oh my god.

Erin Welsh: This is mirrored-

Erin Allmann Updyke: I, I just-

Erin Welsh: -in the fall of the Inca Empire.

Erin Allmann Updyke: This is a really depressing episode.

Erin Welsh: Yep. The Inca Empire, which was mainly in Peru and Ecuador in South America. This time, when Pizarro - so this is another Spanish conquistador - and his 128 specifically men, when they arrived they found an already decimated empire as smallpox had preceded their arrival. And they found these huge structures, these huge towns, these huge buildings, and they looked around and thought there's no way that these few people could have actually done this. What has happened?

Erin Allmann Updyke: Right, right.

Erin Welsh: Yeah cause people were starving because they were dying of smallpox and then they had no one to take care of them. I mean no one to take care of the fields, no one to farm. So even if you survived smallpox, you had no food. It was absolutely terrible, terrible.

Erin Allmann Updyke: I think I'm gonna cry.

Erin Welsh: Well, we're not done.

Erin Allmann Updyke: You're gonna get more depressing? Okay.

Erin Welsh: Yeah, yeah. I mean because we have to talk about North America.

Erin Allmann Updyke: Oh yeah.

Erin Welsh: Historian Elizabeth Fenn tracks a massive smallpox epidemic in North America in the late 1700s, coinciding with the time of the American Revolution. In her book 'Pox Americana' she describes British soldiers who were more protected from smallpox infection because inoculation was more popular in England than it was in the U.S. at the time.

Erin Allmann Updyke: Right. Okay.

Erin Welsh: Anyway, so she describes British soldiers and officers deliberately trying to infect American soldiers where inoculation wasn't as widely accepted.

Erin Allmann Updyke: So is this where they started to decide that all if fair in love and war? They're like, we're just gonna-

Erin Welsh	I mean it's always been all fair in love and war.
Erin Allmann Updyke	Yes, but also they're like, 'I'm not actually gonna try and fight you, I' just gonna get you sick'. Like come on man, that's not cool.
Erin Welsh	Bioterrorism.
Erin Allmann Updyke	Bioterrorism, that's what it is. Your right.
Erin Welsh	Bio warfare at the very least. And so this smallpox epidemic that she describes around the late 1700s was not isolated to the colonial states at the time - so the areas of New England and the eastern seaboard - it spread across the country.
Erin Allmann Updyke	And this is, you said, American Revolution right?
Erin Welsh	The years she describes are 1770-1775.
Erin Allmann Updyke	Okay.
Erin Welsh	One of the reasons that smallpox was so devastating for native North and South American populations is because these were completely naïve. They had never been exposed to smallpox before and so, for instance, the Spanish conquistadors had probably been exposed as children. Or the English, they across the board had lower mortality rates ranging around 30%. Whereas, to read about it, some Native American groups had mortality rates of upwards of 90%, 100%. I mean it was unbelievable.
Erin Allmann Updyke	But one of the ways that they figured out how to end up with the vaccines is that if people were exposed to other forms of pox viruses by living with other animals then even if they never got smallpox, if they were exposed to another form of pox virus, might have had some sort of immunity. Which was why you saw lower mortality rates in the European population.
Erin Welsh	This is a nice little segue into talking about inoculation and vaccination and the relevance to the fight against smallpox.
Erin Allmann Updyke	Yeah.
Erin Welsh	Inoculation as a practice had been around for hundreds of years in certain cultures and regions such as among groups in Western Africa and in Turkey. But western medicine had ignored the practice, chalking it up to old wives tales and uneducated nonsense.
Erin Allmann Updyke	So can you explain what inoculation is?
Erin Welsh	Sure. Inoculation is the practice of taking a material, so usually pus or skin, from a person who had an active smallpox infection-
Erin Allmann Updyke	Ew.
Erin Welsh	Yeah. Taking that and then injecting it or inserting it in some way into an individual who had never been exposed to smallpox.
Erin Allmann Updyke	Basically exposes them directly to the infectious gunk.

Erin Welsh: But through a root which was not as common.

Erin Allmann Updyke: Right because it's a respiratory virus, so.

Erin Welsh: Right. And so what was the usual outcome of inoculation was a mild smallpox infection. The vast majority of patients who were inoculated survived, so the mortality rate for inoculation was 2.5%.

Erin Allmann Updyke: Wow that's a lot lower than 20-40%.

Erin Welsh: Right. So you were way better off becoming inoculated.

Erin Allmann Updyke: That's 10x lower. Ayo!

Erin Welsh: Yeah, it's 10x lower. Yeah, so you had a mild infection and you generally recovered without any scars or pockmarks. However during the time that you did show symptoms of your mild smallpox infection, you were infectious to others and so it was still really a dangerous practice in some ways.

Erin Allmann Updyke: Oh. Okay that makes sense.

Erin Welsh: Inoculation was not very popular then in western culture. So in parts of Europe and in North America. But then, around the same time in the early 18th century, which is the early 1700s-

Erin Allmann Updyke: I was gonna ask cause I'm the worst at those numbers.

Erin Welsh: That's okay. Two people on two different continents - one a highborn woman in England whose name was Lady Mary Montague, and the other a reverend in colonial Boston named Cotton Mather.

Erin Allmann Updyke: Cotton. (southern accent) Good old Cotton Mather. Where did you say he was?

Erin Welsh: Boston.

Erin Allmann Updyke: Oh. That wasn't a very good Boston accent.

Erin Welsh: I just, I wonder how that name fell out of style. Anyway these two took note of these practices and tried to bring them to the places they lived. The story goes that Lady Mary was a beautiful, popular woman.

Erin Allmann Updyke: Aren't they all?

Erin Welsh: And then she got smallpox at 26.

Erin Allmann Updyke: (gasp) Oh, baby.

Erin Welsh: Which left her pockmarked, eyelash-less...

Erin Allmann Updyke: If you are a woman, especially at that time. That's it. You might as well be dead.

Erin Welsh: I mean, forget about it. Thank god she was already married.

Erin Allmann Updyke: Oh thank god.

Erin Welsh: And horribly fearful of the disease which had killed her favorite brother in the same epidemic.

Erin Allmann Updyke: Wait, her favorite brother?

Erin Welsh: Yeah that's from the book. (laughs)

Erin Allmann Updyke: You can have an outward favorite. That's not, I mean...

Erin Welsh: Okay whichever brother is listening to this, you're my favorite.

Erin Allmann Updyke: That's rude.

Erin Welsh: She moved with her husband to Turkey, where she saw that smallpox wasn't viewed with the same terror as it was in England. There she first encountered inoculation, the practice, like we said, of grafting a bit of active smallpox into an unexposed person.

Erin Allmann Updyke: Okay. So she got smallpox before she learned what inoculation was.

Erin Welsh: Yes.

Erin Allmann Updyke: Okay, got it.

Erin Welsh: Lady Mary immediately saw the enormous potential of inoculation and ordered her children to be inoculated.

Erin Allmann Updyke: Yeah, me too. I would.

Erin Welsh: Oh yeah. Upon her return to England she tried to popularize it but most doctors and the general public were horrified. One, they figured that actively giving yourself a disease was basically suicide. And crazy.

Erin Allmann Updyke: I mean it sounds pretty crazy.

Erin Welsh: Sounds pretty crazy. And two, that this was going against the will of god.

Erin Allmann Updyke: Oh! Gotta bring god into it at some point.

Erin Welsh: Because if god wanted you or your kids to die of smallpox, then so be it.

Erin Allmann Updyke: Then you should die. Wow.

Erin Welsh: Yep. To combat some of this incredibly stupid nonsense-

Erin Allmann Updyke: (laughs)

Erin Welsh -Lady Mary and a few pro-inoculation doctors designed an experiment in which they would inoculate a bunch of people who had never had smallpox to show to the public, and also themselves because they weren't entirely sure, that inoculation was a safe practice.

Erin Allmann Updyke I hope that they got permission.

Erin Welsh Guess who they chose?

Erin Allmann Updyke Oh, let me guess. Prisoners?

Erin Welsh Uh-huh.

Erin Allmann Updyke And children, maybe?

Erin Welsh What kind of children?

Erin Allmann Updyke Oh, foster children! Orphans.

Erin Welsh Orphans.

Erin Allmann Updyke Orphans, yep.

Erin Welsh Prisoners and orphans.

Erin Allmann Updyke (singing) Prisoners and orphans! Always at the end of the short stick!

Erin Welsh (singing) Medical ethics!

Erin Allmann Updyke (laughs) Was not a practice at this time.

Erin Welsh No, no. Well regardless, the experiment worked. Which is good at least.

Erin Allmann Updyke Oh, that's good. Yeah.

Erin Welsh A somewhat similar sequence of events occurred in Boston except that there was no formalized experiment on repressed populations, just people going up to this doctor named Dr. Zabdiel Boylston-

Erin Allmann Updyke Boylston? That's a terrible... But also very appropriate for the occasion.

Erin Welsh I mean it was the early 1700s, yeah.

Erin Allmann Updyke Boylston studying smallpox.

Erin Welsh Yeah. And asking him to inoculate them.

Erin Allmann Updyke Okay so at least in this case it was willing volunteers?

Erin Welsh: For the most part.

Erin Allmann Updyke: That's gotta be the first time that the U.S. has done it right. Ayo! Just kidding, I don't know.

Erin Welsh: (laughs) I mean, who knows? He did catch a lot of flack though for inoculating people because it was also hugely unpopular and actually survived several assassination attempts.

Erin Allmann Updyke: Oh wow, interesting.

Erin Welsh: Eventually the numbers couldn't be ignored. Inoculation carried a mortality rate of 2.5 while, like you said, natural infection was upwards of 30.

Erin Allmann Updyke: Yep.

Erin Welsh: Inoculation became patchily popular throughout the 18th century but was dethroned by vaccination in 1793.

Erin Allmann Updyke: (gasp) Oh!

Erin Welsh: You're probably somewhat familiar with this story or at least the name of its star, Edward Jenner. Eddie was just going about his life as a country doctor-

Erin Allmann Updyke: Eddie!

Erin Welsh: -when he noticed that milkmaids who had once been infected with cowpox, never got infected with smallpox. So cowpox is a much milder infection in humans with basically no chance of mortality.

Erin Allmann Updyke: Cause I'm guessing that it is a virus that generally infects cows?

Erin Welsh: You're right about that.

Erin Allmann Updyke: Ooh, I'm so good at the guessing.

Erin Welsh: (laughs) He decided to try to take some of the pus of an active infection of cowpox and then put it into the skin of a completely unexposed person to cow or smallpox.

Erin Allmann Updyke: Interesting. So it's kind of like an inoculation but with a different virus.

Erin Welsh: A more mild virus.

Erin Allmann Updyke: A more mild form. Okay, cool.

Erin Welsh: And Jenner tried this out on eight-year-old farmhand James Phipps. Hello Medical Ethics Board? Where are you? Still nowhere?

Erin Allmann Updyke: James was like (woozy noises).

Erin Welsh: He's like, 'I guess I got no choice'.

Erin Allmann Updyke And he's like, 'Poke you!' (laughs)

Erin Welsh (laughs) But was Jenner supposed to just sit around and wait for smallpox to come to James Phipps? Nope! Smallpox would come to James via Jenner, who directly exposed him. Luckily for James and the rest of the world, his previous exposure to cowpox fully protected him.

Erin Allmann Updyke Awesome!

Erin Welsh Yeah it's actually a huge step. Huge.

Erin Allmann Updyke Hold on! So he gave James Phipps, poor little kid, cow hand, stuck him with cowpox and then he exposed him to smallpox?!

Erin Welsh Uh, yeah. That's the sequence.

Erin Allmann Updyke Wow, that's awful. I'm so glad it worked!

Erin Welsh Yeah, so if James.

Erin Allmann Updyke (laughs)

Erin Welsh Jenner decided to call this practice 'vaccination'. 'Vacca' meaning cow in Latin. Yeah. So that's where vaccination comes from, it's pretty cool.

Erin Allmann Updyke That is awesome. So literally the word 'vaccination' that we use now for all vaccines-

Erin Welsh All vaccines.

Erin Allmann Updyke -is because of smallpox.

Erin Welsh Yep, vacca.

Erin Allmann Updyke That is so cool.

Erin Welsh Like inoculation, vaccination took a little bit to catch on but once it did it spread faster than the smallpox virus around the world.

Erin Allmann Updyke That was a really good one.

Erin Welsh Thanks. And enabled doctors to eradicate this disease which had plagued humanity for millennia. Which brings us to eradication.

Erin Allmann Updyke Yeah! (singing) Eradication.

Erin Welsh The gold star on this story. The bright, shining moment to lift you up.

Erin Allmann Updyke (trumpeting sounds)

Erin Welsh I think for most of us smallpox feels ancient, like a thing of history. Like the 1600s. I mean when Columbus came over... It feels so far removed from where I am in terms of thinking about people who are actually infected by it. But did you know that in the 20th century smallpox killed over 300 million people? That's more than all 20th century wars combined. WWI, WWII, Vietnam War, so many wars. And also more than the 1918 flu.

Erin Allmann Updyke It's also the population of the United States of America.

Erin Welsh Yeah.

Erin Allmann Updyke There's what, 350 something million?

Erin Welsh 300 million people.

Erin Allmann Updyke That was in the 20th century alone?

Erin Welsh Yeah. Uh-huh.

Erin Allmann Updyke Oh my god.

Erin Welsh Now, thankfully, though it is a thing of the past.

Erin Allmann Updyke Yeah.

Erin Welsh Smallpox death toll in the 21st century? Zero. So far. But I'm getting ahead of myself. In 1966 the World Health Organization, the WHO, proposed a plan to eradicate smallpox and put D.A. Henderson in charge of carrying it out. Over the next 12 years, thousands of people traveled to some of the world's most remote corners, living in extremely challenging conditions, and working in conflict-ridden countries to administer smallpox vaccine in an attempt to eliminate it completely. And it worked. The last natural case of smallpox infection occurred in Somalia on October 31st, 1977. Over 40 years ago this month.

Erin Allmann Updyke Wow.

Erin Welsh And it happened in a 23-year-old cook named Ali Mao Malin who had actually once worked as a smallpox vaccinator despite never having been vaccinated himself.

Erin Allmann Updyke Wait, so he worked administering the smallpox vaccine to people, never got vaccinated, and then was the last natural case of...?

Erin Welsh Isn't that funny?

Erin Allmann Updyke That is really funny, I did not know that.

Erin Welsh Yeah. Once news of his infection reached the WHO a team was sent to vaccinate the around 90 people who had come into contact with him.

Erin Allmann Updyke Isn't that crazy? 90 people that he came in contact with before they were able to be like, 'Oh man we need to isolate this person'.

Erin Welsh: Luckily he survived the infection and no more cases emerged. The world was declared smallpox-free on May 8th, 1980. And this guy actually, Ali, went on to work very hard for the Carter Foundation to eliminate polio.

Erin Allmann Updyke: Oh wow!

Erin Welsh: But he died last year of malaria.

Erin Allmann Updyke: Oh that's sad.

Erin Welsh: Sorry. He was 63.

Erin Allmann Updyke: Oh that's so young. Oh god.

Erin Welsh: I wish the story of smallpox could end here but I have a sad story to share.

Erin Allmann Updyke: Oh, why?

Erin Welsh: Remember how I said Malin was the last natural case of smallpox?

Erin Allmann Updyke: Yeah.

Erin Welsh: I use that qualifier because there was another case after his.

Erin Allmann Updyke: What? Come on.

Erin Welsh: In England, August 11th, 1978. A medical photographer, Janet Parker, became ill and started showing signs of smallpox.

Erin Allmann Updyke: Wait, in England?

Erin Welsh: In England.

Erin Allmann Updyke: What? That's ridiculous.

Erin Welsh: Oh yeah, just listen on. It turns out she had used a phone booth in a building which shared an air duct with a smallpox research lab and some of the virus must have escaped through the duct into the booth, where she inhaled it. She and her mother both came down with smallpox and possibly her father, but he died of a heart attack before symptoms appeared.

Erin Allmann Updyke: Oh my god.

Erin Welsh: Her mother made it, Janet did not. The scientist whose lab it was, Dr. Henry Bedson, committed suicide after this whole ordeal.

Erin Allmann Updyke: Oh! Oh my... The person who was the one in the building studying smallpox when he heard-

Erin Welsh: He felt responsible. I'm sorry to end on a sad note.

Erin Allmann Updyke Yeah, what the heck! We could have stopped it at eradicated!

Erin Welsh But smallpox is gone! Mostly.

Erin Allmann Updyke Yeah.

Erin Welsh At least it remains the only human infectious disease to have been eliminated. Though I'm hopeful that those words will be wrong within a few years when polio and guinea-worm are gone.

Erin Allmann Updyke Wouldn't that be great.

Erin Welsh Yeah. So Erin, smallpox is eradicated. Does that mean we don't have to worry about it?

Erin Allmann Updyke Oh hell no.

Erin Welsh Oh no. Now I'm also really worried about it.

Erin Allmann Updyke Yeah, no lie. Me too. Basically were all forked.

TPWKY (transition theme)

Erin Welsh I read something in one of the books about how a Russian scientist defected to the U.S. after he had been working in a lab whose goal it was to make a more virulent vaccine-resistant strain of smallpox.

Erin Allmann Updyke Yeah.

Erin Welsh This was in the 80s and this, it turns out that this lab had not been listed on any register as to the remaining places that smallpox was supposed to be held. So in case you don't know, smallpox is officially-

Erin Allmann Updyke On paper at least.

Erin Welsh -exists in two labs. One in the U.S.-

Erin Allmann Updyke Right, two specific buildings. One, the building is called Corpus Six, it's at Vector, which is a research institution in Russia. The other place it exists on paper is in the Maximum Containment Laboratory at the Center for Disease Control in Atlanta in the United States. Those are the only two places in the world on paper that smallpox virus exists.

Erin Welsh But you're a fool if you believe that those are the only places it is. Because North Korea definitely has smallpox.

Erin Allmann Updyke I have a whole list of a bunch of countries.

Erin Welsh France, not that we're that worried about France but, you know...

Erin Allmann Updyke I'm worried about France. I don't know why. I'm just saying. I'm just worried about every...

Erin Welsh	(laughs) You just irritated a whole lot of people!
Erin Allmann Updyke	Let's see. India, Pakistan, China, Israel, Iraq, North Korea, Iran, possibly China, possibly Taiwan, possibly France. Yeah dude. That's a whole lot of countries.
Erin Welsh	I mean who's gonna go, 'Oh yeah, here's all the smallpox. Wink.' Like everyone.
Erin Allmann Updyke	So the World Health Organization, back when they were sort of trailblazing on this eradication effort, they were getting really close to eradicating the disease, they started sort of strongly suggesting that everyone who was doing research on smallpox either destroy their stores of the vaccine or send them to the U.S. and Russia.
Erin Welsh	There was a date around 1995 when everyone was supposed to have... Actually, okay, sorry. So prior to 1995 all of these countries were supposed to have sent their samples to Russia or the U.S. And then in 1995 Russia and the U.S. were supposed to destroy the samples.
Erin Allmann Updyke	Yes. And so basically what has happened is that every few years since then, there is a convention and people decide should we destroy everything or should we wait a few years for research purposes. And that has literally been what has happened every few years until this day. Those stores still exist, people are maybe still doing research, it's really hard to find any information about what type of research might be happening.
Erin Welsh	Well they certainly were following 9/11. Actually before and during. So since 9/11, since the anthrax scare, smallpox has been considered to be one of the more viable threats in terms of bioterrorism because it is so fatal, it is so infectious - or at least infectious enough - and it can be dispersed very easily.
Erin Allmann Updyke	Right, it's airborne.
Erin Welsh	It's airborne.
Erin Allmann Updyke	It's airborne.
Erin Welsh	And so it's a really interesting ethical issue.
Erin Allmann Updyke	It is.
Erin Welsh	Because there's no more smallpox in the world, do we continue... How do we justify the continued research funds, research animals?
Erin Allmann Updyke	Yeah. And at this point really the only reason that it is quote unquote 'justified' to keep these stores of smallpox virus is because of the threat of bioterrorism. And so we need to be able to develop vaccines, we need to be able to do research. But then that is only because we think there are other people out there doing research to potentially make this a weapon, and so...
Erin Welsh	But there are. Like that has been verified.
Erin Allmann Updyke	Well yeah that's the thing, I mean it's not like it's just one person or one entity that's doing that and then everyone else is just trying to defend against it, right? It's likely everyone who is doing research on how to weaponize it. This is just us talking, but I mean this is also just logic.

Erin Welsh	I think it's a very real fear that this could be weaponized because there was research done on mousepox. So a group of researchers in Australia manipulated the mousepox virus to defeat the vaccine so that vaccinated mice died or were susceptible to mousepox virus. And that could be very easily done with smallpox as well.
Erin Allmann Updyke	And the other thing is that the smallpox vaccine is extraordinarily imperfect. Imperfect is sort of a nice word to use for it. Currently today about 20% of people would not be eligible to be vaccinated for the smallpox vaccine.
Erin Welsh	Right, so before you go jumping to your doctor and trying to get ahold of the smallpox vaccine - first of all, it's not gonna happen.
Erin Allmann Updyke	They're never gonna give it to you.
Erin Welsh	Second of all, you may not be-
Erin Allmann Updyke	Eligible. So anyone with eczema or who lives in a household or who has family members with eczema is not eligible to get the vaccine.
Erin Welsh	If you're pregnant.
Erin Allmann Updyke	Or if you live in a house with babies, you cannot get it. What else? If your immunocompromised.
Erin Welsh	Auto-immune. Yep.
Erin Allmann Updyke	Any sort of autoimmune disease or are on chemotherapy or have HIV. Or, honestly, if you probably live in a household with an immunocompromised person because the thing is that the current vaccination for smallpox is another virus. It is not a modified, killed form of the smallpox virus it is a live, active, different virus that they inject you with under your skin that actually causes a viral infection, it's just very localized to one pock essentially.
Erin Welsh	Right, so you've probably seen the scars.
Erin Allmann Updyke	Yes. And I used to actually think that the scar was because the way that they injected the vaccine was like a big-
Erin Welsh	I did too! So there are things that are vaccine guns, which they use. Did you see these?
Erin Allmann Updyke	Yes! Well that's what I used to think that the scar is from. But it's not at all.
Erin Welsh	No it's because that's the way that the pock formed.
Erin Allmann Updyke	There was an actual pock there.
Erin Welsh	And actually this reminds me, one of the things that makes smallpox such a good candidate for eradication, there are multiple reasons. One, you can easily tell who's been vaccinated or not judging by the smallpox scar that they have or the vaccination scar. The second is that the vaccine itself, when freeze-dried, has really high longevity and it's really stable. And so you can transport it to these tropic countries where there tend to be more cases of smallpox. And the third is that there is no known animal host.

Erin Allmann Updyke

Reservoir.

Erin Welsh

Thank you. Reservoir. And so for instance, if you eliminated it entirely from humans, if it still could infect animals or animals were a reservoir for it, it means that humans could still potentially be exposed.

Erin Allmann Updyke

Right. That's why there are so many diseases that, as much as we would like to eliminate them, it's nearly impossible because there are animal reservoirs for so many diseases.

Erin Welsh

The other thing about the smallpox vaccine, besides the fact that about 20% of the population could not be vaccinated in case of an outbreak, is that though there are probably swaths of the population that were vaccinated either as children or - I double-checked with my brother-in-law - some active duty military people also get vaccinated depending on where they... I don't know if it's what branch of the military they are in or if it's where they are going to be sent to, but they are also given the vaccine. But immunity tends to only last about 4-5 years. So if you were vaccinated a few years ago or when you were a child, you are no longer immune, essentially. So if there were any sort of outbreak that happened today-

Erin Welsh

Sorry.

Erin Allmann Updyke

Yeah. It does you no good.

Erin Welsh

I mean, it could be the case that you have a lesser infection, like a lesser degree of infection.

Erin Allmann Updyke

That's possible, yes. You might end up with the sort of mixed form or whatever. Is that what it's called? Modified.

Erin Welsh

Modified.

Erin Allmann Updyke

You might end up with the modified form but still pretty gnarly.

Erin Welsh

I think our point is, how scared should you be of smallpox? Pretty scared.

Erin Allmann Updyke

Really, really, forkin' scared. Seriously.

Erin Welsh

Seriously. I mean smallpox, despite having been completely eradicated is so important and so relevant for today for a number of reasons. One of which is bioterrorism, the other of which is the vaccine scare. Which I don't want to get into the whole nitty-gritty on, 'Oh vaccines are bad for you'.

Erin Allmann Updyke

We're gonna get too angry at this time of night, I think, if we get into that.

Erin Welsh

Yes, yes. But I think it is really fascinating to see these parallels between vaccination when it was first introduced and nowadays and the pushback against that and the reasons why. And I think that the absence of diseases, such as visible diseases such as smallpox, really lead people to forget how important vaccination really is.

Erin Allmann Updyke

That's the thing is it's really easy when you're so far removed. The thing that I think is so crazy is that not a single physician in the world who has been trained since the late 1970s has ever seen a case of smallpox. Ever. And hopefully they never, ever, ever will.

Erin Welsh: Hopefully.

Erin Allmann Updyke: But-

Erin Welsh: Oh I think it's incredible.

Erin Allmann Updyke: It's absolutely incredible but the thing is that I'm in medical school right now. We have never talked about smallpox besides to say that this is a disease that has been eradicated. We've never talked about the symptoms in depth. It's eradicated.

Erin Welsh: They're like, 'Don't worry, we got you. The WHO has got ya.'

Erin Allmann Updyke: Right. And so to think that if there were to be, even if you don't think of about it from a sort of large-scale bioterrorism aspect, if you just think of, what if a few particles somehow got out?

Erin Welsh: In a lab accident such as happened to Janet Parker.

Erin Allmann Updyke: Exactly. I mean if something like that were to happen, could we even diagnose it in order to contain it? Isn't that scary? I thought of that while doing all of this research.

Erin Welsh: Is there a movie that has smallpox?

Erin Allmann Updyke: Not that I know of.

Erin Welsh: There should be. Screenwriters, get on this.

Erin Allmann Updyke: Yeah, are you hearing this guys? This is scarier than the movie Contagion.

Erin Welsh: Oh, way scarier.

Erin Allmann Updyke: Yeah. At one point we talked about doing a sort of threat-level on all of these episodes, like (old-timey voice) 'Terror threat-level orange' or whatever.

Erin Welsh: This is threat-level wear a diaper, cause you're about to pee your pants.

Erin Allmann Updyke: (laughs) Yeah.

Erin Welsh: We have no scale. Right?

Erin Allmann Updyke: No scale, yeah. We don't have a scale.

Erin Welsh: But in reality, yeah. Be really scared. Smallpox is awful.

Erin Allmann Updyke: It's really terrifying.

Erin Welsh: But wait, we've been using the wrong verb tense. Smallpox was awful.

Erin Allmann Updyke: It was.

Erin Welsh: Thank goodness.

Erin Allmann Updyke: Thank goodness. Thank you, World Health Organization.

Erin Welsh: It's actually amazing what they accomplished.

Erin Allmann Updyke: It really is. We should let people know if they'd like to read more because some of these books are really amazing. You've got a list.

Erin Welsh: I've got a list.

Erin Allmann Updyke: Hit me with them.

Erin Welsh: If you wanna know more about inoculation and the development of inoculation as a practice in England and the U.S. you should read 'The Speckled Monster' by Jennifer Lee Carrell. If you are interested in the nitty-gritty of the epidemic that happened in North America from 1777 to 1785, you should check out 'Pox Americana' by Elizabeth Fenn. 'Smallpox: The Death of a Disease' by D.A. Henderson is a book penned by the leader of the eradication effort himself and it is an amazing book. It is really great.

Erin Allmann Updyke: Also, don't you have a signed copy of that book in your personal collection?

Erin Welsh: I do! I got it on like AbeBooks or Amazon and it's signed! I'm so thrilled.

Erin Allmann Updyke: By literally the person who was the reason we were able to eradicate this disease, D.A. Henderson. Props.

Erin Welsh: The other book that I think you should read is called 'The Demon in the Freezer' and it's by Richard Preston. It reads like a movie script. It is really exciting. It's more about the eradication effort of smallpox and then anthrax, in term of bioterrorism. It's a little dated but it's really still really good. 'The Power of Plagues' by Erwin Sherman; it's a compilation book with chapters on different disease or on different topics in terms of plagues and epidemics throughout history. And all of those ar great, we really recommend them. So if you're interested, read more.

Erin Allmann Updyke: Yeah. Check it out.

Erin Welsh: Check it out. Fact-check us.

Erin Allmann Updyke: That'd be fun. If we're wrong, let us know man.

Erin Welsh: Yeah, we'd love to hear. Cause we're just doing this for fun.

Erin Allmann Updyke: Yeah it's very fun.

Erin Welsh: It is. So what's happening next week, speaking of more fun?

Erin Allmann Updyke: I don't know, what is happening next week?

Erin Welsh: Cholera!

Erin Allmann Updyke	Cholera!
Erin Welsh	Yeah.
Erin Allmann Updyke	Oh man, that's gonna be fun.
Erin Welsh	Cholera's gonna be good. Get ready for some good John Snow puns.
Erin Allmann Updyke	(old-timey voice) 'The king in the north!' That was my first attempt.
Erin Welsh	(old-timey voice) 'The king of the cholera!'
Erin Allmann Updyke	We'll work on it.
Erin Welsh	Yep, we got a long way to go.
Erin Allmann Updyke	Please, please, please, please, please rate and review us on iTunes or wherever you get your podcasts.
Erin Welsh	And subscribe.
Erin Allmann Updyke	And that is how other people are able to find this podcast. So if you like us, then you think other people would like us, then you should definitely rate and review us so that other people can find us in the first place.
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Erin Allmann Updyke	Yep, we post that every week. This Podcast Will Kill You, our Twitter is our acronym. I can't spell it.
Erin Welsh	TPWKY.
Erin Allmann Updyke	That's it. I think that's it.
Erin Welsh	All right everyone. Wash your hands.
Erin Allmann Updyke	Ya filthy animals!