

TPWKY

This is Exactly Right.

Erin Welsh

June 20th. With the help of Father Vigano, I tried to persuade some English sailors whose duty it is to bury the dead from the city and other hospitals, to let me take the buboes from the dead before they are buried. A few dollars conveniently distributed and the promise of a good tip for every case have a striking effect. The bodies, before they are carried to the cemetery, are deposited for one or two hours in a cellar. They are already in their coffins in a bed of lime. The coffin is opened. I move the lime to clear the thigh region. The bubo is exposed. Within less than a minute I cut it away and run to my laboratory. I see a real mass of bacilli, all identical. From the bubo I inoculate agar tubes, mice, and guinea pigs. My bacillus is most probably that of plague but I am not certain.

June 21st. I go on cutting and examining buboes. I always find the same bacillus extremely abundant. My animals inoculated yesterday are dead and show the typical plague buboes.

TPWKY

(transition theme)

Erin Allmann Updyke

(laughs) I love that.

Erin Welsh

It was really nerdy. (laughs)

Erin Allmann Updyke

It was so perfectly... Like I could imagine the exact scientist who was like 'boop-beep-boop-boop' you know?

Erin Welsh

Well the exact scientist was Alexander Yersin in the year 1894, which is when he discovered, yep, that's right, *Yersinia pestis*.

Erin Allmann Updyke

Oh my gosh!

Erin Welsh

The causative agent of plague.

Erin Allmann Updyke

Yersin!

Erin Welsh

Yersin.

Erin Allmann Updyke

I never knew where it got its name, now I know.

Erin Welsh

Yeah, a Swiss scientist. And also, even though he probably was the first to actually describe and identify the bacterium, he did not get credit for a while because he did not publish in English, which is very interesting.

Erin Allmann Updyke

Oh, interesting. So in Switzerland, what language did he publish in? German or French?

Erin Welsh

Probably German.

Erin Allmann Updyke

Cool. Interesting.

Erin Welsh

Yeah.

Erin Allmann Updyke

How fun. Hi and welcome to Episode 6 of This Podcast Will Kill You!

Erin Welsh: Yes. My name is Erin Welsh.

Erin Allmann Updyke: And I'm Erin Allmann Updyke. And this is plague part two.

Erin Welsh: Yeah. Before we start off, we want to tell you guys about a few other podcasts that are awesome and you guys should totally check out.

Erin Allmann Updyke: Yeah as if, you know, you have all the time in the world to listen to all the podcasts. Let's tell you about some of our favorites.

Erin Welsh: Yeah, yeah. So our friend Matt Candeias, who is also a student with us, produces a podcast called 'In Defense of Plants' and it's an awesome, awesome, awesome botany podcast. It's like top rated on iTunes.

Erin Allmann Updyke: He interviews really awesome people and it's just a really great podcast in general. You know... look out for a crossover episode in the future.

Erin Welsh: Yes!

Erin Allmann Updyke: We also made a Twitter friend which to me is the most exciting thing in the world. I don't know if that's nerdy but when we got our first Twitter friend I was like, I wanted to die of excitement.

Erin Welsh: (laughs) Yeah, as someone who doesn't really do Twitter at all, I was in the dark about this. But Erin was really excited.

Erin Allmann Updyke: I almost like, I squealed so hard. But anyways we made friends because I found this podcast called 'The Femmes of STEM' which is this amazing podcast all about the history of women in science, technology, engineering and math, which is STEM. And each episode focuses on a different woman and all of her amazing accomplishments in the field. It's super interesting, it's hosted by a badass lady named Michelle. It's great, you should definitely check it out.

Erin Welsh: There's also another super cool podcast we want to tell you about and it's created and produced by our friend Shane Campbell Staton-

Erin Allmann Updyke: Woop woop!

Erin Welsh: (laughs) And his friend Arien Darby. It's called 'The Biology of SUPERheroes' and in it they talk about some of your favorite comic book heroes and the biological principles underlying their superpowers.

Erin Allmann Updyke: It's gonna be amazing, the first episode is being released on December 1st.

Erin Welsh: So it'll already be out by the time this episode is out.

Erin Allmann Updyke: Oh cool, great.

Erin Welsh: I was gonna say the first episode just dropped and it's all about Peter Parker and his spidey physiology.

Erin Allmann Updyke Oh my god I can't wait to listen!

Erin Welsh Yeah, it's gonna be really good.

Erin Allmann Updyke I'm thrilled about it.

Erin Welsh It's gonna be super high quality. Yeah.

Erin Allmann Updyke Yeah. Major. Major. What are we chatting about today, Erin?

Erin Welsh Well this week, just like last week, we're doing something a little bit unusual. So the topic of plague is so huge that we needed to split it up into two weeks. So this is part two.

Erin Allmann Updyke So if you missed part one, pause here, go and download Episode 5 and then meet us back here in like an hour. Okay?

Erin Welsh Yeah. That Episode 5 will give you the biological background and historical context that you may need for this next episode.

Erin Allmann Updyke Yeah.

Erin Welsh So this episode we're gonna be talking all about the plague in modern times and ending with the discussion of the recent outbreak in Madagascar and what that means for the rest of the world.

Erin Allmann Updyke Cool.

Erin Welsh I guess we should start, though, with our quarantini.

Erin Allmann Updyke It's quarantini time!

Erin Welsh What do we have on the menu for this episode, Erin?

Erin Allmann Updyke Another Bubo Bebida.

Erin Welsh Oh okay! Is this one the pneumonic variety?

Erin Allmann Updyke Yes, absolutely. Yeah.

Erin Welsh Okay okay.

Erin Allmann Updyke So this one's mad with vodka.

Erin Welsh Okay so it's just another extra dry martini with vodka and-

Erin Allmann Updyke And this time we used an olive just to mix it up.

Erin Welsh There we go.

Erin Allmann Updyke Maybe olives are more pneumonic, I don't know.

Erin Welsh	(laughs)
TPWKY	(transition theme)
Erin Welsh	Well how about we start with an overview of the biology just as a refresher?
Erin Allmann Updyke	That's a great idea. So just to review, plague is a disease that is caused by a bacteria known, as we mentioned, as <i>Yersinia pestis</i> . It is spread in several different ways and the route of transmission determines the type of disease that you get. So the most famous form is bubonic plague and that disease is acquired when it is transmitted by the bite of an infected flea. Pneumonic plague on the other hand is when bubonic plague spreads to infect your lungs and then can be transmitted via respiratory droplets, AKA coughing. And then the third type of plague is known as septicemic plague and that means that the bacterium has infected your bloodstream and proliferated in your blood.
Erin Welsh	And there are different mortality rates associated with each of these forms, right?
Erin Allmann Updyke	Absolutely. So bubonic plague is the least fatal of the three, it has mortality rates of 30-60% if untreated. And then pneumonic plague is the most virulent and it has up to 100% mortality rate if left untreated. The good news is all three is of these types of disease are treatable with antibiotics as long as you can get to them fast enough.
Erin Welsh	Super.
Erin Allmann Updyke	Super dupes.
Erin Welsh	Okay, I think that's a cool little refresher.
Erin Allmann Updyke	Biology in a nutshell.
TPWKY	(transition theme)
Erin Welsh	So now let's pick up where we left off last week which is more or less at the beginning of what historians call the third pandemic. So we talked about last week the first pandemic which was the Plague of Justinian; the second pandemic which was the Black Death and then the local epidemics that followed that in the centuries after; the third pandemic began in 1855 in China and spread to India and some other places as well. Over the course of that one year, more than 12 million people died in those two countries alone.
Erin Allmann Updyke	Wow! 12 million?
Erin Welsh	12 million. Although the death toll of the third pandemic could not hold a candle to that of the Black Death-
Erin Allmann Updyke	Right, nothing can. The Black Death.
Erin Welsh	No. It's the mother of all plagues.
Erin Allmann Updyke	Yeah, definitely.

Erin Welsh	One of the significant outcomes of it was that by the early 1900s, plague was endemic in wild rodent populations all around the world.
Erin Allmann Updyke	Wow.
Erin Welsh	And by this time both the black rat and its flea had a global distribution. This was thanks to the widespread, rapid global travel that was now possible. Infected rats brought infected fleas onto boats which would enter every port town. At the edges of these port towns you would find human dwellings encroaching onto natural areas which allowed for the intermingling of domestic and wild rodents. And the rat fleas had no preference, they were just happy to have so many available hosts. If humans and wild rodents came into close contact, as they did following deforestation or whenever human settlements were built in previously natural areas, plague could make the jump from rodent to human host via the bite of an infected flea.
Erin Allmann Updyke	Mm-hmm.
Erin Welsh	And this is what the third pandemic saw. Pockets of plague, some larger than others, popping up in parts of every continent except for Antarctica. And also most of Western Europe, actually, which is funny considering the Black Death impacted a lot of Western Europe.
Erin Allmann Updyke	Interesting.
Erin Welsh	It was during this pandemic in the late 19th century that substantial medical research was finally done on the plague. It's route of transmission via infected fleas was identified. The importance of rat populations was realized. The causative agent, little bacilli <i>Yersinia pestis</i> , was described. Even with all these pretty monumental advances in the medical underpinnings of plague, there was still a long way to go. The earliest vaccines and antibiotics used to prevent or treat plague infection were developed in the late 1800s but these weren't all that great. If you received either, your chances of dying were reduced by about 20% or 30%.
Erin Allmann Updyke	Wow.
Erin Welsh	That's it.
Erin Allmann Updyke	That's it? Gosh.
Erin Welsh	Yeah. Promising but not really that reassuring.
Erin Allmann Updyke	No!
Erin Welsh	No. Improvements continued to be made and now there is a functional plague vaccine but it still has its problems, mostly with longevity in the protection it offers and on the logistical side. It takes multiple courses to immunize. Antibiotics on the other hand are still effective against plague, for now.
Erin Allmann Updyke	Thank goodness.
Erin Welsh	For now.
Erin Allmann Updyke	For now but thnak goodness for now.

Erin Welsh Thank goodness. In the 1940s is when streptomycin which is usually used to treat plague now was discovered. Even with all of these ways to combat plague, it persisted. But actually that verb tense it wrong. It continues to persist. In many regions of the world, including Madagascar, plague is considered to be an endemic disease. And what is an endemic disease, Erin?

Erin Allmann Updyke An endemic disease is a disease that is sort of constantly occurring at low levels in a population.

Erin Welsh Thank you.

Erin Allmann Updyke You're welcome!

Erin Welsh Although the pandemic was declared to be over in 1959, so the third pandemic was according to the WHO done in 1959.

Erin Allmann Updyke That's it, no more?

Erin Welsh That was by no means the last year that plague caused an epidemic.

Erin Allmann Updyke Oh definitely not.

Erin Welsh Let's take a little detour to Vietnam in the 1960s.

Erin Allmann Updyke (laughs) Oh dear.

Erin Welsh In the midst of the Vietnam War when the U.S. military was over there fighting in a pointless war they never should have started and devastating entire communities.

Erin Allmann Updyke Getting political! Not really. Are we really though?

Erin Welsh Yeah, sorry, maybe. (laughs) Well, getting factual. Sidenote, did you know that in Vietnam this war is referred to as the American War? Or the resistance war against America?

Erin Allmann Updyke I did hear that, yes. I did know that.

Erin Welsh Anyway, one of the tactics employed by the U.S. military during this time was using chemical warfare to destroy crops and sterilize the land. They did this to try to weaken the North Vietnamese Army by depriving them of food. The problem with that, besides being morally bankrupt and evil, is that the army would just commandeer food from civilians. So it mostly had the effect of starving entire communities and villages to death. Which honestly was probably the intention of the U.S. military all along to weaken the army by terrorism.

Erin Allmann Updyke Yeah, sounds like the point.

Erin Welsh The U.S. Department of Defense estimates that about 12% of the farmable land and forest was sterilized during this bombing campaign-

Erin Allmann Updyke Oh my god.

Erin Welsh Although the Vietnamese government puts the amount closer to 45%.

Erin Allmann Updyke Jesus.

Erin Welsh What this destruction did was to drive the wild rodents out of these deforested, destroyed areas into human settlements where there was at least still some food.

Erin Allmann Updyke Whoa.

Erin Welsh As you might expect, this resulted in a massive outbreak of bubonic plague.

Erin Allmann Updyke Oh my god! That is not something you learn about in like 7th grade history class.

Erin Welsh It's not.

Erin Allmann Updyke Holy crap!

Erin Welsh Between 1965 and 1970, over 25,000 plague cases were reported in South Vietnam.

Erin Allmann Updyke That's just the reported ones.

Erin Welsh Reported not actual.

Erin Allmann Updyke Wow.

Erin Welsh The actual total was probably closer to 100,000-250,000.

Erin Allmann Updyke (gasp)

Erin Welsh Not joking, not exaggerating. That's what I found.

Erin Allmann Updyke Holy crap.

Erin Welsh In a country where prior to U.S. invasion there were only about 15 cases a year reported. Most of the cases occurred in small, isolated villages where I couldn't find exact figures, but I'm sure the death rate was really high.

Erin Allmann Updyke Yeah because if you don't have access to medicine then even if you're getting bubonic plague, that's still a 60% mortality rate, you know. That's ridiculous.

Erin Welsh Some American soldiers also came down with the plague but they were able to get treatment right away.

Erin Allmann Updyke Surprise, surprise.

Erin Welsh And most of them were vaccinated anyway. This is just one of the many nasty, shameful chapters of American history.

Erin Allmann Updyke Ugh. That is a whole other podcast, there are multiple many other podcasts about that.

Erin Welsh Yeah. Okay.

Erin Allmann Updyke Back to the plague.

Erin Welsh Back to the plague. A lot of you, particularly those listening in the U.S. may think of plague as a thing of the past, a medieval disease that has been gone for centuries. Although you maybe have to be living under a rock if you still think that with this latest outbreak in Madagascar. But even with this plague outbreak, you may think that you don't have to worry about plague, living in the U.S.

Erin Allmann Updyke Wrong.

Erin Welsh Well, you're probably mostly right to think about that.

Erin Allmann Updyke Eh, wrong.

Erin Welsh We'll get into that, the details of that more later. But in terms of natural infections, yeah.

Erin Allmann Updyke Yeah, that's true.

Erin Welsh Did you know though that there have been over 1000 cases of plague in the U.S. since the early 1900s? 1000, that's it. But still.

Erin Allmann Updyke Still!

Erin Welsh Still.

Erin Allmann Updyke Still that's 1000 people.

Erin Welsh In the early 1900s, plague tended to pop up in port towns when plague-infected rats disembarked from ships and their fleas headed into town for a little barfing fun.

Erin Allmann Updyke (laughs)

Erin Welsh Outbreaks were reported in San Francisco, Oakland, Hawaii, some Oregon coastal towns, and several of these outbreaks were dominated by the pneumonic, more deadly form of the disease. The fleas then headed east over land, transmitting plague into the wild rodent populations of the Southwest and West. After about the 1920s, plague ceased to be a port city disease in the U.S. and instead became one of incidental contact with dead or infected animals. Every year from the 1920s until now, cases of plague were reported.

Erin Allmann Updyke Yep.

Erin Welsh One boy from New Mexico died after skinning a dead coyote he came across. Same for another, but this time it was a squirrel instead of a coyote. Another with a rabbit.

Erin Allmann Updyke Cause like we mentioned before, the dead bodies remain infectious, right, because basically they are just full of bacteria. So especially some rodent species but especially carnivores are very hard hit by plague and so they have very high bacterial loads. So basically we're saying don't play with roadkill, guys.



Erin Welsh: I know, which is kind of a shame because roadkill can be a useful study thing.

Erin Allmann Updyke: Sure yeah but just wear gloves. (laughs)

Erin Welsh: Wear gloves when you play with roadkill.

Erin Allmann Updyke: Yeah.

Erin Welsh: Several people also got sick when their pets contracted plague from infected wild rodents, like the cats that we mentioned last episode.

Erin Allmann Updyke: That's so sad.

Erin Welsh: Sorry for you cat people out there.

Erin Allmann Updyke: Just like trying to love on your cat and they're sick and they're coughing and you're like 'oh poor baby' and then they cough in your face and then you both die of plague. (laughs)

Erin Welsh: Yeah. Since 1965 there have been over 460 cases of plague in the U.S.

Erin Allmann Updyke: Wow.

Erin Welsh: With 16% of those infected dying.

Erin Allmann Updyke: Geez! That's a really high mortality rate!

Erin Welsh: Yeah. With the use of antibiotics and everything? Yeah.

Erin Allmann Updyke: I wonder if that is largely due to people not being able to recognize it or doctors not wanting to diagnose something like plague.

Erin Welsh: Right, so that kind of begs the question why is plague still killing people when there's a vaccine; when there's antibiotics? And probably that depends on where you are geographically.

Erin Allmann Updyke: Definitely. Big time.

Erin Welsh: But overall, plague is still a very nasty disease.

Erin Allmann Updyke: Yeah.

Erin Welsh: And antibiotics, even if administered early, can't always save you or even save you from the nasty side effects that you will get from plague infection.

Erin Allmann Updyke: Plus, even if you live in a place like the United States where if you have health insurance at least, then you in theory have access to a physician to get antibiotics. And even if you have a physician that diagnoses it early, we don't always go to the doctor when we're feeling sick. And with something like plague that can come on so rapidly, you might not get those antibiotics until too late even if you have access to them. So...

Erin Welsh: Yeah. And so in some areas it could be that's it's underdiagnosed.

Erin Allmann Updyke: Definitely.

Erin Welsh: Or not diagnosed early enough. But in other areas where plague is endemic, such as Madagascar, getting antibiotics to people who need them is often a huge logistical struggle and there is a lot of under-reporting of the disease which can prolong an epidemic.

Erin Allmann Updyke: Mm-hmm.

Erin Welsh: The story of the plague in Madagascar starts in 1898 when the disease first appeared after a ship from India full of rice, rats, and plague arrived at the island. Since then there have been plague deaths every year, some years worse than others. The plague, usually in bubonic form, tends to pop up every year in Madagascar between September and April but this year it was a little early. Erin, can you tell me a little bit about the plague situation in Madagascar today?

Erin Allmann Updyke: I would love to. So we're gonna walk through this entire outbreak and then we're gonna talk about what, honestly, a great job WHO has done in trying to contain this, pretty much. So.

Erin Welsh: I cannot wait to hear it.

Erin Allmann Updyke: I'm excited. So the current plague outbreak in Madagascar begins on August 23rd.

Erin Welsh: 2017

Erin Allmann Updyke: 2017, yeah. (laughs) August 23rd of this dang year. When a 31-year-old male reported malaria-like symptoms. He started to come down with malaria-like symptoms. So headache, fever, malaise. On the 27th of August, so four days later, he began experiencing respiratory symptoms while in a shared taxi.

Erin Welsh: Uh oh.

Erin Allmann Updyke: He later died.

Erin Welsh: Uh oh!

Erin Allmann Updyke: His body was prepared for his funeral at a hospital without any safety procedures. 31 people who came into contact with this individual case either directly or indirectly through shared taxi contacts or contacts with the funeral people became ill and four of them died.

Erin Welsh: How many people became ill?

Erin Allmann Updyke: 31 people from that one person initially.

Erin Welsh: Whoa! And he died how soon after showing symptoms?

Erin Allmann Updyke: Within a few days.

Erin Welsh: Okay. Okay.

Erin Allmann Updyke The outbreak was officially detected on September 11th after a 47-year-old female was admitted to the hospital with respiratory failure because of pneumonic plague.

Erin Welsh Ugh, gosh.

Erin Allmann Updyke So that was when they first realized that this was an outbreak. By the 18th of September, so this is just one month after that initial man, there had already been 51 cases of pneumonic plague-

Erin Welsh The bad one.

Erin Allmann Updyke The bad one. And 12 deaths reported. There had been an additional 53 cases of the bubonic plague and 7 deaths elsewhere in the country.

Erin Welsh Interesting. I have questions about the origin.

Erin Allmann Updyke Yeah, I do too. So there wasn't, at least what I found, a ton of detail on the specifics of how many index cases there might have been. They had the details of this specific story.

Erin Welsh And so this guy who was the index case-

Erin Allmann Updyke Right.

Erin Welsh -had pneumonic plague?

Erin Allmann Updyke Yes.

Erin Welsh And so those people that were-

Erin Allmann Updyke Or he had bubonic plague that became pneumonic for sure.

Erin Welsh Okay, okay. And so those people that got bubonic plague, that indicates that there was a bubonic plague outbreak that was not related to him necessarily?

Erin Allmann Updyke Exactly. Necessarily, exactly. Yeah. Because bubonic plague is not transmitted person to person, that is transmitted by the bites of the fleas.

Erin Welsh Okay. Gotcha.

Erin Allmann Updyke By October 2nd, just a few days later, that number of 51 cases of pneumonic had jumped to 73. By November 2nd, and part of the massive increase in this number has to do with better reporting, but by November 2nd, that number had jumped to 1801 cases of pneumonic plague.

Erin Welsh Whoa! That's a lot of dang cases.

Erin Allmann Updyke By the 15th of November, which is the most recent data that I found, the total count stands at 2119. Over 2100 total cases. That is considering both what they call confirmed, so laboratory confirmed cases, probable cases, and suspected cases. And 171 deaths which is an 8% case fatality rate.

Erin Welsh Wow.

Erin Allmann Updyke

Yeah. But what's interesting is that's quite low because the vast majority of these cases were clinically classified as pneumonic plague and not bubonic plague. So for pneumonic plague that's actually a fairly unusually low fatality rate.

Erin Welsh

Which indicates potentially that there was a rapid response?

Erin Allmann Updyke

It could indicate that, it could indicate that for some reason this was just like an unusually not virulent strain. But WHO has done an amazing job at responding to this outbreak. So let's talk about what happens in the case of an outbreak because I think it's thrilling, it's what I wanted to do for my job for a long time.

Erin Welsh

Yeah! Wanted?

Erin Allmann Updyke

Wanted. Want to? CDC hire me! Just kidding, kind of.

Erin Welsh

(laughs) Yeah, looking for post-docs.

Erin Allmann Updyke

(laughs) Yeah not kidding. But so what happens when you have a suspected outbreak is a whole mass of people from the WHO, from the CDC, from Doctors Without Borders, Médecins sans frontières, right, they're all sent to the place with the main goal of finding the index case, the initial person or persons who could have sort of started this outbreak. And in order to do that you have to do what we've referred to before as boots-on-the-ground epidemiology. You have to go there and interview people who were either friends of the patient, family of the patient, healthcare workers, everyone who ever came into contact with that patient and then trace their contacts back and back back. And additionally you have to do surveillance of all of those contacts to see who might develop symptoms in the future.

Erin Welsh

And so that means going back and checking with them everyday to say, 'Are you sick? What is your temperature like? Are you showing any symptoms?'

Erin Allmann Updyke

Exactly. Right. Yes.

Erin Welsh

It's a lot of man hours.

Erin Allmann Updyke

Exactly, human hours let's call it. (laughs)

Erin Welsh

It's a lot of human hours of work.

Erin Allmann Updyke

It really is. And so in the case of this plague outbreak there have been over 2000 cases but there have been over 7000 contacts of each of these cases identified. And of those, 95% of them have completed seven day followups, so that means they've been contacted every day for seven days. Because like we said, the incubation period tends to be between 1-7 days so you have to follow them up for a whole week. You can imagine if this were a disease with a longer incubation period, it's just that much more work to followup on these people.

Erin Welsh

Yeah that is a lot of effort to put into that.

Erin Allmann Updyke Mm-hmm. And they also were all given prophylactic antibiotics. So one thing about the plague that's nice is that prophylactic antibiotics can help in reducing the chances that you end up showing symptoms of plague. Out of those 7000 contacts only 9 of them actually ended up becoming suspected cases, which I think is interesting.

Erin Welsh So imagine that you have plague, just you listener and you Erin. And how many people do you come in contact with? And if you have pneumonic plague, over the course 24 hours of a normal, let's say, work day, how many people - because we just tend to hang in the house on Sundays, I think.

Erin Allmann Updyke Yeah. (laughs) I actually went to a birthday party today with children.

Erin Welsh Oh! That's perfect!

Erin Allmann Updyke Oops. Sorry.

Erin Welsh (laughs) Yikes.

Erin Allmann Updyke Yeah, I mean you'd have to followup with each of those people that I interacted with at that birthday party. There was probably, I don't know, 15 people there. And then go to each of their families and everyone they contacted, I mean... It's insane. Especially-

Erin Welsh It radiates outward endlessly.

Erin Allmann Updyke In 2017 when we are so mobile, right? Like this man, this index case, he shared a taxi with multiple people. So you need to find... How do you even find, if you're in an Uber today, can you even find if you do Uber sharing and you are with a random person? Like how do you even find those people? It takes a ton of real detective work to find all these people and make sure that you're following up in order to sort of put a ring around the outbreak and try and contain it.

Erin Welsh Mm-hmm.

Erin Allmann Updyke And most of the reports that I have seen say pretty specifically... Well, most of the news articles about the Madagascar outbreak specify that it has been limited to Madagascar. However, on October 10th a man was reported to probably have pneumonic plague in Seychelles.

Erin Welsh I saw that news article and then that was the last I saw of it. So is it possible that he was a traveler who came from Madagascar?

Erin Allmann Updyke Right, so he did come from Madagascar. However... Yeah so he had visited Madagascar and he returned to Seychelles on the 6th of October. From that one person, they monitored 320 contacts of this person. Eight of them ended up developing mild symptoms. But of those 320 contacts, 41 of them were passengers on his flight from Madagascar back.

Erin Welsh Ew, imagine being on a flight and getting contacted by United Airlines. 'Knock knock, hello. You were on this flight, you may have pneumonic plague'.

Erin Allmann Updyke It's crazy, yeah. It's just insane.

Erin Welsh Thank goodness there are antibiotics.

Erin Allmann Updyke That should be the name of this episode.

Erin Welsh (laughs) Could be something a little bit better.

Erin Allmann Updyke (laughs) What else about that plague?

Erin Welsh Well as of... SO we are recording this on November 19th 2017, and as of today it has been three weeks and one day since a case has been confirmed.

Erin Allmann Updyke Right, the last confirmed case of bubonic plague happened on the 24th of October and the last confirmed case of pneumonic plague was the 18th of October. However like we've said before, plague is endemic to Madagascar and plague season extends until April. So the surveillance efforts are not finished and the risk is not entirely done. However it seems like the worst of this outbreak is hopefully over.

Erin Welsh Hopefully, yeah.

Erin Allmann Updyke Hopefully. It's crazy though. I mean, it was a massive outbreak because it's over 2000 cases. From 2010-2015 there was only just over 3000 cases of plague reported worldwide.

Erin Welsh Wow!

Erin Allmann Updyke And 584 deaths.

Erin Welsh So this is a big one, yeah.

Erin Allmann Updyke It's massive! Yeah, it's definitely one of the biggest. Plague is certainly not limited to Madagascar, Madagascar does tend to be one of the countries that has the greatest burden of it year after year, but just in the 2000s alone there have been outbreaks in Zambia, India, Malawi, Algeria, the Democratic Republic of Congo, China, Peru, and Madagascar.

Erin Welsh Mm-hmm.

Erin Allmann Updyke And those are just the outbreaks, that's not counting sort of individual cases like we see in the U. S. almost every year.

Erin Welsh Right, right.

Erin Allmann Updyke Yeah. So plague is definitely not over.

Erin Welsh Should we talk about how scared we need to be today?

Erin Allmann Updyke Oh my go. (laughs)

Erin Welsh If you listened to last week's episode, you might remember that the use of plague in bioterrorism is nothing new.

Erin Allmann Updyke Right.

Erin Welsh  
In fact it's many centuries old. When the Mongol army threw bodies of plague victims over the city wall of Kaffa, they were hoping to bring down the city with this awful disease. While their efforts may have been ineffectual, there have been more successful attempts in the last 100 years. There's a true story from the early 20th century of two half-brothers in India who were joint heirs to an estate.

Erin Allmann Updyke  
(laughs)

Erin Welsh  
Yeah. Do you know where this is going?

Erin Allmann Updyke  
No but I'm excited about it.

Erin Welsh  
One day, one brother met the other brother unexpectedly at a train station and gave him a hug goodbye. During this encounter the other brother, the one who was hugged, felt a pinprick on his arm. Eight days later he was dead.

Erin Allmann Updyke  
No way!

Erin Welsh  
Turns out - I'm not making this up.

Erin Allmann Updyke  
Is this verified?!

Erin Welsh  
This is from this book 'Plague and Ancient Disease in the 20th Century', so take it up with Charles Gregg.

Erin Allmann Updyke  
Charles Gregg.

Erin Welsh  
You better be right about this, Charles.

Erin Allmann Updyke  
Is this like Wikipedia status, Gregg?

Erin Welsh  
No he's a researcher or was a researcher at Los Alamos.

Erin Allmann Updyke  
All right, all right, Mr. Gregg.

Erin Welsh  
So I think he knows what he's talking about.

Erin Allmann Updyke  
Tell me about it.

Erin Welsh  
Anyways, so the guy who felt the pinprick on his arm?

Erin Allmann Updyke  
Yeah.

Erin Welsh  
Died eight days later. Turns out his brother had recently taken out a huge life insurance policy on him-

Erin Allmann Updyke  
Oh my god.

Erin Welsh -and then teamed up with a microbiologist, I'm not making this up, to get some plague bacilli. While he was hugging his brother, the microbiologist injected some of the plague bacilli into the guy to kill him.

Erin Allmann Updyke Oh. My. God.

Erin Welsh They were both found guilty of murder. (laughs)

Erin Allmann Updyke Most microbiologists are not like this. (laughs)

Erin Welsh (old-timey voice) 'And I would've gotten away with it if it weren't for you pesky microbiologists.'

Erin Allmann Updyke (laughs) Oh my god I can't believe that!

Erin Welsh Isn't that crazy?

Erin Allmann Updyke That's... Oh my...

Erin Welsh It's like, 'I've got an idea.'

Erin Allmann Updyke 'I've got an idea of an elaborate way to kill my brother.' How did they really figure out that it was not just a naturally infected case of plague? Did he say-

Erin Welsh They broke under questioning. I don't know. (laughs) I mean if I've seen one CSI case, I've seen them all. Slash HOUSE slash I don't know. A great crossover episode between the two?

Erin Allmann Updyke Yeah. Yeah.

Erin Welsh You had potential, guys. There's another story of plague as a bioterrorism agent in WWII.

Erin Allmann Updyke (gasp) This is a fun one.

Erin Welsh This is a fun one.

Erin Allmann Updyke Well it's not, actually.

Erin Welsh This is a shocking one, I would say.

Erin Allmann Updyke I would also say it's a really interesting one and I wanna talk about why. So go.

Erin Welsh Apparently the Japanese army had been experimenting on Chinese prisoners by making plague bombs intending to weaponize plague, particularly pneumonic plague, and cause epidemics of it. Apparently around 3000 prisoners died and the Japanese army escaped prosecution by the Allied forces by turning over their research findings to the U.S.

Erin Allmann Updyke Wow. That's interesting. So I has read a slightly different story.

Erin Welsh Well there are some more, yeah.



Erin Allmann Updyke: Yeah. What is the more?

Erin Welsh: Well there are also some reports from China that the American air force deployed some biological warfare agents in North Korea during the Korean War in the early 1950s.

Erin Allmann Updyke: Huh. So I had read that a quote: "Secret branch of Japanese army unit 731 is reported to have actually dropped infected fleas all over populated areas of China."

Erin Welsh: Uh huh, that's the same one. Yes.

Erin Allmann Updyke: Which what I think is really interesting about that is that, not that we're trying to tell you how to do bioterrorism, but that's not a good way to do it.

Erin Welsh: Well clearly they were experimenting.

Erin Allmann Updyke: Yeah. I mean, I guess. It's just really interesting because-

Erin Welsh: Trial and error, trial and error.

Erin Allmann Updyke: (laughs) Yeah. But bubonic plague is not as infectious and it's not as virulent and so it's an interesting...

Erin Welsh: So it's very possible that that endeavor, dropping infected fleas on different towns, was what led to their attempt to create pneumonic plague bombs.

Erin Allmann Updyke: Right, yeah. So there are lists of a few disease that the WHO and several other organizations have sort of a task force to look out for and plague is one of the ones that is considered one of the most terrifying. The most likely?

Erin Welsh: It should be noted also that Russia has been working on weaponizing plague for decades now.

Erin Allmann Updyke: Interesting. Like confirmed.

Erin Welsh: Well, it's confirmed with smallpox.

Erin Allmann Updyke: All right, all right.

Erin Welsh: So highly suggested in some of the dossiers that...

Erin Allmann Updyke: Yeah. What's interesting about plague in contrast to something like smallpox, which we've talked about the bioterrorism potential of that, is that *Yersinia pestis* is widely available. Whereas smallpox is only, whether it's in many different governments' hands or only a few different governments' hands, it still is in the hands of governments worldwide. Whereas *Yersinia pestis* is everywhere. You can go to Colorado, you can go to California, you can get plague bacteria quite easily from a flea, from a rat, from whatever.

Erin Welsh: Yes.

Erin Allmann Updyke: And because it has the capacity to be mass produced and to be aerosolized and to be transmitted in that way, it is a really terrifying prospect in terms of a bioterrorism agent.

Erin Welsh: In some ways yes, but also... Okay, so let's just say that someone manages to weaponize plague and makes it the pneumonic form and then makes it antibiotic-resistant.

Erin Allmann Updyke: Right.

Erin Welsh: Scary. That's probably the scariest scenario we have.

Erin Allmann Updyke: That is definitely.

Erin Welsh: And then releases it into a city.

Erin Allmann Updyke: Yes.

Erin Welsh: Pneumonic plague kills you so rapidly that the period of infectivity is relatively low compared to other diseases and so while it is a very scary prospect, let's say it's not the best or most effective bioterrorism agent. And that an outbreak could likely be contained pretty rapidly, the way that it has been in Madagascar.

Erin Allmann Updyke: So what it sounds like you're talking about is the R0 of plague.

Erin Welsh: Oh, yes!

Erin Allmann Updyke: So R0, dear listeners - so excited.

Erin Welsh: So this looks like a capital R with a subscript zero.

Erin Allmann Updyke: Right, and we call that 'R naught'. So R0 is the basic reproductive rate of a pathogen. What that means is the number of secondary cases that happen from a single primary case if everyone in your population is susceptible. Yeah? And so in the case of pneumonic plague, you're right. The R0 is estimated to be only about 1.3 which means that on average, only 1.3 people, it's an average, is actually infected from every person who has pneumonic plague. That's in contrast to something like smallpox which has an R0 of guess what?

Erin Welsh: I don't know.

Erin Allmann Updyke: Around 6.5.

Erin Welsh: Whoa!

Erin Allmann Updyke: Yeah, yeah.

Erin Welsh: Interesting.

Erin Allmann Updyke: Yeah, so that's something that... Cause as I was reading this, I was like 'Why am I not more scared of plague? Do I need to be? What's the R0?' And it was actually more difficult than I expected to find that number. But yeah, it's quite low compared to other potential bioterrorism agents that are maybe more scary or even other infections like measles which has an R0 of 13!

Erin Welsh: Wow!

Erin Allmann Updyke It's one of the highest.

Erin Welsh Oh we have to do an episode on that.

Erin Allmann Updyke Oh we definitely will.

Erin Welsh Okay.

Erin Allmann Updyke But also just get vaccinated and then we don't have to worry about it.

Erin Welsh (laughs) It's a little harder, I think, in some areas than others.

Erin Allmann Updyke Yeah.

Erin Welsh Like Orange County. (laughs)

Erin Allmann Updyke God, unfortunately. Mom! Just kidding, she vaccinated us.

Erin Welsh Overall it seems like plague is still a scary organism and it's still clearly causing a lot of disease and deaths-

Erin Allmann Updyke Definitely.

Erin Welsh -in certain areas of the world. But in terms of a bioterrorism agent it's not the best one or not the one we need to worry the most about.

Erin Allmann Updyke Right it's on the list, I think, that people who are in charge of worrying about those things are worrying about it. So like on the day to day, don't let it keep you up at night.

Erin Welsh And let's just say also that bubonic plague, pneumonic plague is a disease that is once again mostly concentrated in countries that are economically poor or economically struggling and with improved sanitation, with improved surveillance of disease and so on, that these diseases could be brought to very, very low levels.

Erin Allmann Updyke Yeah. Especially with plague it's all about surveillance and monitoring because if you are able to catch individual cases, you can prevent the spread. So while... And you also can prevent initial infection if you don't have houses that are infested with fleas. So with improving infrastructure you can help prevent things like that.

Erin Welsh Okay. So plague, that was a big one.

Erin Allmann Updyke It was! Two whole episodes.

Erin Welsh Yeah. Part two, slightly shorter but not any less sweet. (laughs) I guess.

Erin Allmann Updyke (laughs)

Erin Welsh We want to... Oh do you have any reading materials to cite or did you already do that?

Erin Allmann Updyke	I actually don't, I got all of my information from WHO. Thanks so much for what you do.
Erin Welsh	Okay, yeah. Once again I'll just do a shout-out fro 'Plague and Ancient Disease in the 20th Century' by...
Erin Allmann Updyke	Gregg.
Erin Welsh	Charles Gregg.
Erin Allmann Updyke	Gotchu. Gotchu, girl.
Erin Welsh	We want to also thank Bloodmobile for the music yet again. Doing a stellar job.
Erin Allmann Updyke	Kicking it.
TPWKY	(transition theme)
Erin Welsh	And please remember to rate, review, and subscribe and also feel free to email us at <a href="mailto:thispodcastwillkillyou@gmail.com">thispodcastwillkillyou@gmail.com</a> if you have any suggestions or questions.
Erin Allmann Updyke	Or corrections.
Erin Welsh	Or corrections, any of those things. We are happy to hear from you, we would love to hear from you.
Erin Allmann Updyke	And follow us on social media.
Erin Welsh	Twitter, Instagram, Facebook.
Erin Allmann Updyke	Cause we like to hear from you. Thanks for listening!
Erin Welsh	Wash your hands.
Erin Allmann Updyke	Ya filthy animals!