

TPWKY

This is Exactly Right.

(This Podcast Will Kill You intro theme)

Erin Welsh

Hi and welcome to This Podcast Will Kill You. I'm Erin.

Erin Allmann Updyke

And I'm also Erin.

Erin Welsh

Thanks for joining us.

Erin Allmann Updyke

(laughs) Thanks for tuning in. This is our very first episode.

Erin Welsh

Why are we here, Erin?

Erin Allmann Updyke

Well, we just really like talking about infectious diseases and we decided to start this podcast as an outlet to talk about them more.

Erin Welsh

And we are graduate students currently studying disease ecology and epidemiology.

Erin Allmann Updyke

We're not posing as experts, that's for sure.

Erin Welsh

But we really like learning about this stuff and figure that other people might like learning about infectious diseases too.

Erin Allmann Updyke

So every episode we'll focus on one particular infectious disease.

Erin Welsh

We're gonna start with some basic definitions, then talk about the biology of the pathogen.

Erin Allmann Updyke

Hit you with some history.

Erin Welsh

Then round it off with what the status of the disease is today.

Erin Allmann Updyke

And we'll end each episode by letting you know just how scared you need to be.

Erin Welsh

Welcome to Episode 1.

Erin Allmann Updyke

Today we're talking about Influenza.

Erin Welsh

What is considered America's greatest pandemic.

Erin Allmann Updyke

Possibly the greatest pandemic of all time.

Erin Welsh

Depending on your metric.

Erin Allmann Updyke

Right.

Erin Welsh

We'll get into that.

Erin Allmann Updyke

We'll get into it. So pull up a chair, pour yourself a drink, and let's get started.

Erin Welsh

Bringing it back to 1918! (laughs)

Erin Allmann Updyke

What are you drinking over there, Erin?

Erin Welsh

What are you drinking?

Erin Allmann Updyke

Oh, I'm drinking a quarantini!

Erin Welsh

Oh my gosh, so am I. What kind of quarantini are you drinking?

Erin Allmann Updyke

Today we're drinking the 'H1 Drink 1'.

Erin Welsh

Inspired by the classic cocktail from the 1800s called 'Corpse Reviver'.

Erin Allmann Updyke

Corpse Reviver, people.

Erin Welsh

This is actually 'Corpse Reviver No.2', there are multiple variants.

Erin Allmann Updyke

Yeah. So if you'd like to follow along and drink, or should I say, if you'd like to drink along at home (laughs) you can make your very own by mixing, what is it? Equal parts-

Erin Welsh

Gin.

Erin Allmann Updyke

Lemon juice. Cointreau?

Erin Welsh

Cointreau and Lillet Blanc.

Erin Allmann Updyke

Which is a weird sounding thing.

Erin Welsh

It's a French liqueur.

Erin Allmann Updyke

You can find it at the liquor store.

Erin Welsh

Mix and serve over ice. It's really delicious.

Erin Allmann Updyke

It's surprisingly great for something named 'Corpse Reviver'.

Erin Welsh

Actually, this is a little bit of pre-trivia. This Was a popular drink during the 1918 pandemic.

Erin Allmann Updyke

Oh my god, that's amazing!

Erin Welsh

Yeah. So every week we are going to be drinking quarantinis with our own special names inspired by classic drinks or ones that we makes up on our own and we'll post the recipes, and if you want to drink along with us, please do so.

Erin Allmann Updyke

We would love that.

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(transition theme)

Erin Allmann Updyke

So let's define some of the words that people might not know that we're probably going to use a lot both in this episode and going forward.

Erin Welsh

Let's start off with 'epidemic'.

Erin Allmann Updyke

So an epidemic is an outbreak of a disease that is greater than what we would normally see in that particular population.

Erin Welsh

Okay, and so I often hear the word 'pandemic', can you tell me what that is?

Erin Allmann Updyke

Right. So a pandemic is essentially just an epidemic that has spread to be in many countries and/or usually the entire globe.

Erin Welsh

What about 'pathogen'?

Erin Allmann Updyke

A pathogen is a bacteria, a virus, or even a parasite such as a worm, that causes disease.

Let's jump right in.

I'm gonna take you back. All the way back to 1918. That was the year, in case you didn't know (laughs), that's the year of the great Influenza pandemic. So we're gonna start with some first-hand accounts, just to really get you in the mood of what life was like during this pandemic. Are you ready?

Erin Welsh

I'm ready.

Erin Allmann Updyke

Okay. I'll read you a few first-hand accounts from people, I guess most of whom survived since they were able to write their account after.

Erin Welsh

Oh there are some that didn't.

Erin Allmann Updyke

There are some that didn't. This is a story from Josie Mabel Brown. These are from the documentary, which you can find on YouTube, called 'The American Experience: Influenza 1918' or something similar to that. So this is Josie Mabel Brown's story. She was a nurse at the Great Lakes Naval Station during the 1918 pandemic and this story was told by her niece. Her niece said:

"As she walked into the ward, not only were the 42 beds full, but there were boys that were laying on the floors and on the stretchers waiting for that boy in the bed to die. They were having raging fevers and delirium and profuse nosebleeds and their lungs would collapse and it would go into this horrid, bloody pneumonia."

Erin Welsh

That sounds more like it's from a movie script than it does real life.

Erin Allmann Updyke

Right? And that was real life in 1918.

Erin Welsh

That was 99 years ago this time of year.

Erin Allmann Updyke

Yeah, it's terrifying. We've got another one. This is Dr. Victor Vaughan - yeah, I know right, it's exciting - he was at a base near Boston called Camp Devens. He said, this is his actual words. He said:

"I saw hundreds of young, stalwart men-"

Which I assume means like a strapping young man.

"Stalwart young men in uniform coming into the wards of the hospital. Every bed was full, yet others crowded in. Their faces wore a bluish cast, a cough brought up blood-stained sputum."

63 men died the day he arrived at Camp Devens. That's at one camp alone, on one day.

Erin Welsh

Remarkable. Horrifying.

Erin Allmann Updyke

It's remarkable, it's incredible. And I think I have one more story that I'd like to tell just because it's...Well, I've got a gravedigger story, but who doesn't have a gravedigger story?

Erin Welsh

Uh, I want to hear the gravedigger story.

Erin Allmann Updyke

You want to hear the gravedigger story? Okay. The gravedigger story is from Arthur Duery Davis, and this is not from that same documentary. This is actually, you can find these on the CDC which is the Center for Disease Control's website. They have this very fascinating storyboard all about the 1918 flu with tons of survivor and also not survivor, sufferer stories told from either first-person perspective or from their immediate family. And it's absolutely fascinating. So here's one of those stories. This man, Arthur Duery Davis, worked at like a logging camp and his family was in Tennessee during the flu. And so this is one story that he told his son:

"One morning at 6:00 AM I was set to work digging three graves for a family of six that lived down the road from my home. Around 9:00 AM the doctor sent word to dig yet another grave. Then around lunchtime I got word to dig yet another grave. And by 4:00 PM I was instructed to dig the final grave for that entire family."

Erin Welsh

Oh my god!

Erin Allmann Updyke

I know, it's depressing. We're starting with a downer.

Erin Welsh

I can't even imagine what it would be like. I mean, think about...You're a teacher.

Erin Allmann Updyke

Kind of, sure.

Erin Welsh

Well you teach a class. Think about going to class one day and realizing what proportion of those kids, cause they're all the ripe age as we'll find out, would not be coming to class a month from now cause they'd be dead of Influenza.

Erin Allmann Updyke

That's absolutely terrifying.

Erin Welsh

I mean it would be insane. Plus, not to mention the fact that college classrooms are kind of the perfect place to breed this virus.

Erin Allmann Updyke

Oh, they're filthy, filthy, disgusting humans, college students. (laughs)

Erin Welsh

Yes we are.

Erin Allmann Updyke

Okay, so maybe we'll leave it at that. Was that depressing enough to start us off with Influenza?

Erin Welsh

I think so. I think it gave us a sense of time and place.

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(transition theme)

Erin Welsh

So zooming out from those stories, let's talk a little bit about the history of Influenza itself. Now, all of us, I'm sure, know or have heard about seasonal flu, get your flu shot, blah blah blah, oh I can't come in I have the flu, I have stomach flu - not really the flu.

Erin Allmann Updyke

That's probably for a different day that we'll talk about the stomach flu, guys. It's not flu.

Erin Welsh

It's not Influenza. So, Influenza is a viral infection and it has been around for millennia. We don't know exactly how long because the symptoms of flu are so general. Vomiting, nausea, fever, listlessness-

Erin Allmann Updyke

That's a hard word. (laughs)

Erin Welsh

Yeah, it's a really hard one. That it's unclear whether a lot of the epidemics that have been written about in history are flu or could've been some other respiratory ailment, could've been pneumonic plague. But it does seem clear that there are some in Europe in the 12th century, in the 15th century, in the 16th century, that can be pretty conclusively tied to Influenza.

Erin Allmann Updyke

Wow, that's fascinating that it goes that far back.

Erin Welsh

Well, it goes even farther back. So the first of what historians call a reliable description of Influenza was done by Hippocrates himself.

Erin Allmann Updyke

Oh my gosh!

Erin Welsh

The father of Western medicine. What we do know for certain is that the Influenza virus was the causative agent for the huge pandemic in 1918 that killed - wait for it - 50-100 million people worldwide.



Erin Allmann Updyke

50-100 million people?

Erin Welsh

So before diving into the pandemic itself, I want to bring you up to date a bit about the context, the historical context surrounding this huge pandemic. So let's talk about Western medicine at the time.

So Western medicine was in its infancy, really. Throughout the 1800s, early to mid 1800s, bacteriology really got up and running. We had Pasteur discovering a lot of bacterial causative agents of diseases, there were some inoculations going on, vaccines, Edward Jenner with his smallpox hit in the late 1700s, epidemiology began as a science in 1854-

Erin Allmann Updyke

And that's fascinating and we'll talk all about that in a future episode, won't we?

Erin Welsh

Yes we will. Thank you John Snow, not from Game of Thrones. Different John Snow.

Erin Allmann Updyke

(laughs)

Erin Welsh

But despite all of the advances of medical research, medical practice was really lagging far behind. And this was due to multiple factors, one being that germ theory was still kind of debated. So germ theory was not widely accepted.

Erin Allmann Updyke

Can you explain a little bit about what germ theory is?

Erin Welsh

I was just about to ask you to do that.

Erin Allmann Updyke

(laughs)

Erin Welsh

Erin, can you tell us what germ theory is?

Erin Allmann Updyke

I would love to. Germ theory is essentially just the idea that many diseases, most normally we think about infectious diseases, are actually caused by microorganisms rather than just, say, the air or the water, which is what was very commonly thought before we realized that there are organisms that are so small that you can't actually see them with the human eye. And that's what actually is causing many infectious diseases.

Erin Welsh

Thank you!

Erin Allmann Updyke

Welcome! (laughs)

Erin Welsh

Excellent, excellent explanation.

So yes, germ theory was not widely accepted amongst doctors, and even if it wasn't widely accepted, a lot of physicians, practicing physicians, were never given a class in this. Medical school was totally achievable for any human being who had enough money.

Erin Allmann Updyke

Oh dear.

Erin Welsh

You could spend a couple of years in U.S. medical schools, up through the early 1900s, prior to the 1918 flu, you could spend a couple years in medical school taking some courses, never actually see or interact with a patient, and graduate with medical degree.

Erin Allmann Updyke

Oh my god.

Erin Welsh

As a result, there was a lot of mistrust among doctors.

Erin Allmann Updyke

Well that's completely understandable.

Erin Welsh

Oh, of course! Doctors back then didn't have the respect that they do today in terms of, 'Oh, I'm going to go to the doctor and I know they will fix my ailment'. So consider the time, 1918. Even though there was a lot of work being done on bacteria, there was still no antibiotics.

Erin Allmann Updyke

Right.

Erin Welsh

There were inoculations so you could to some degree be protected against some diseases, but a lot of ones there was nothing that you could do. In 1918 during the flu pandemic, alcohol was prescribed.

Erin Allmann Updyke

I mean, like...

Erin Welsh

I can get behind that but that's not going to help you.

Erin Allmann Updyke

No, it might make you feel a little bit better because you forget how much pain you're in, but it's certainly not going to cure any of your ailments.

Erin Welsh

So the other thing besides the complete lack of adequate medical training going on in 1918, there was also a war going on.

Erin Allmann Updyke

Oh yeah! There was, wasn't there? It was like, I don't know, the first World War?

Erin Welsh

Yep, the war to end all wars. If only that were the case.

Erin Allmann Updyke

(laughs)

Erin Welsh

What this meant, war means, guess what? Large-scale transport of young men throughout the entire world and crowding.

Erin Allmann Updyke

Very, very much. And also very unsanitary conditions.

Erin Welsh

Very unsanitary.

Erin Allmann Updyke

They were, I mean, digging pits and things and just hundreds of people all slumped together and probably pooping in holes and things.

Erin Welsh

Probably pooping in holes.

Erin Allmann Updyke

Probably pooping in holes.

Erin Welsh

Basically it set the stage for the perfect conditions for transmission of Influenza. So let's get to the pandemic itself.

Erin Allmann Updyke

Ooh, let's!

Erin Welsh

We'll head to Haskell, Kansas, early 1918.

Erin Allmann Updyke

Wow. Kansas of all places! All right, let's go. I'm there.

Erin Welsh

Yup, Kansas. Here we are. A doctor named Loring Miner began to see cases of Influenza that were a lot more severe than he had previously encountered. And this was also notable because A) Like I said, it was a lot more severe, but B) It was also impacting young, strapping men. Otherwise, the people who are least susceptible to Influenza.

Erin Allmann Updyke

Right, because generally it's what? Old people and tiny little babies that actually get severely sick from something like Influenza, right?

Erin Welsh

Right, exactly. He made a note of this and he sent off some letters and some notes to medical journals, to public health officials saying 'Hey, can you help me? Can you send some things? Like this is a problem.' And he got no response.

Erin Allmann Updyke

Oh my god. Just a man trying to be proactive.

Erin Welsh

Just trying to be proactive. These cases started popping up January-February but by March the epidemic had burned itself out basically.

Erin Allmann Updyke

Oh. That's good news.

Erin Welsh

Good news, right?

Erin Allmann Updyke

Yeah.

Erin Welsh

It didn't burn out before a couple of soldiers returned from Haskell back to Camp Funston.

Erin Allmann Updyke

Funston!?

Erin Welsh

Yeah, not very fun I think.

Erin Allmann Updyke

Where is Camp Funston?

Erin Welsh

Also in Kansas.

Erin Allmann Updyke

Oh, okay.

Erin Welsh

Where a super cold winter-

Erin Allmann Updyke

Uh oh.

Erin Welsh

-meant that they had to put a bunch of soldiers together in barracks much more crowded than they ever would have allowed before.

Erin Allmann Updyke

Oh my gosh.

Erin Welsh

Which led to rapid spread of this virus throughout the entire camp. Within a few days people, like hundreds of soldiers, were sick and it didn't remain, of course, isolated at Funston because of the war. Soldiers were being sent to other places in the U.S., other camps in the U.S., over to France, over to England, and thus began the first wave of the pandemic.

Erin Allmann Updyke

Oh my gosh. Way to go, Kansas.

Erin Welsh

Way to go, Kansas. More on that, it might not actually be Kansas. In what historians call the first wave of the pandemic, tens of thousands of soldiers were hospitalized but very few died, which is interesting.

Erin Allmann Updyke

Yeah.

Erin Welsh

During this first wave is where Spanish Influenza picked up its name.

Erin Allmann Updyke

Oh! Let's talk about its name, because a lot of people think if it's called the Spanish Flu it must come from Spain, right?

Erin Welsh

Not so.

Erin Allmann Updyke

Oh, fascinating.

Erin Welsh

So there are a number of theories as to where Spanish Flu actually began, but none of them are Spain.

Erin Allmann Updyke

(laughs)

Erin Welsh

The likeliest scenario according to a lot of historians is Haskell, Kansas, France is another contender where water birds and domestic pigs mixed.

Erin Allmann Updyke

Oh, I'll talk a lot about birds in just a minute.

Erin Welsh

But the reason but it got the name Spanish Flu is because Spain was neutral during WWI. Whereas countries like the U.S., England, France, Germany, all of whom were very hard hit by this first wave, censored their news.

Erin Allmann Updyke

Oh my god. The U.S. censored their news?

Erin Welsh

Shocking.

Erin Allmann Updyke

Shocking. (laughs)

Erin Welsh

So a lot of this came off of, I thought this was really fascinating, came off of...Woodrow Wilson, who was president at this time, passed what is called the Sedition Act of 1918 and it prohibited the use of quote:

"Disloyal, profane, scurrilous, or abusive language about the U.S. government, its flag-

Erin Allmann Updyke

Oh god, aren't we doing that again, too.

Erin Welsh

"-or its armed forces, or that caused others to view the American government or its institutions with contempt."

Erin Allmann Updyke

Oh my god my jaw is on the floor.

Erin Welsh

So this meant that a lot of news about the flu was kept under wraps cause it would have made the U.S. look weak and bad. There's so much I could keep talking about that. There could be an entire, I'm sure there is one, a podcast episode on the Sedition Act because it is dirty. Like if you were walking down the street and you said 'This war sucks', you could be put in prison.

Erin Allmann Updyke

Wow. That's absolute insanity.

Erin Welsh

It's up there with some of the bad, yeah...

Erin Allmann Updyke

Hopefully not what we're about to get into in our current...Where's that drink? (laughs)

Erin Welsh

Yeah, there you go.

During the first wave the flu raged globally from around March to June through August. For instance, between June 1st and August 1st, over 200,000 British soldiers who were stationed in France were hit hard enough that they could not report for duty. So this is 200,000 out of 2 million. Which is 10%.

Erin Allmann Updyke

Wow! That's 10% of the soldiers were sick enough that they couldn't even get up and stand at their bunks or whatever you have to do when you're a soldier. Wow.

Erin Welsh

Yeah, exactly. It was really bad. But then August came around and it was gone.

Erin Allmann Updyke

Oh! So it's good news. Episode over.

Erin Welsh

Episode over. Not so fast. Not. So. Fast.

The second wave began. The second wave was the more lethal wave and it first took hold on U.S. soil by many accounts at Camp Devens outside Boston. We already heard a little bit about Camp Devens.

Erin Allmann Updyke

We sure did.

Erin Welsh

And this started in mid-September. Up to 20% of soldiers were sick at one time and descriptions of the progression of the disease were horrifying.

Erin Allmann Updyke

Ooh, tell me them. I wanna hear them.



Erin Welsh

Okay. Oh, I have a big section on this later on, too.

Erin Allmann Updyke

Oh, good, good, good.

Erin Welsh

Actually, we'll just do all the symptoms right now. Within a couple of hours of admission with standard flu symptoms-

Erin Allmann Updyke

Okay so we're talking aches, chills, fever, etc.

Erin Welsh

-patients were turning blue because their lungs could no longer transfer oxygen into the blood.

Erin Allmann Updyke

(gasp) Oh my god.

Erin Welsh

So let's hear some more symptoms of the 1918 flu.

Erin Allmann Updyke

Let's!

Erin Welsh

Extreme pain, body pain, so much so that physicians at the time were actually not sure if it was Dengue fever, also known as Breakbone fever, because it is so extraordinarily painful.

Erin Allmann Updyke

Wow.

Erin Welsh

Cyanosis, which is what I just mentioned.

Erin Allmann Updyke

Right, that's turning blue, like your actually skin is blue. Like a Smurf.

Erin Welsh

Bleeding from mucus membranes. So, your nose. Sometimes doctor's reported blood spurting out of the nose.

Erin Allmann Updyke

Oh my...Blood spurting out of your nose!?

Erin Welsh

To a couple of feet away.

Erin Allmann Updyke

Holy cow!

Erin Welsh

Dribbling from your mouth, your eyes, ears, and if you're a woman, your vagina.

Erin Allmann Updyke

Well, I mean, doesn't that happen anyways?

Erin Welsh

That's why it took so long to be noted as a sign of disease.

Erin Allmann Updyke

Oh no, it's just your 'woman problems', don't worry, go home. Tend to the children. (laughs)

Erin Welsh

Yeah, well, they couldn't because pregnant women faced the highest mortality rate of all.

Erin Allmann Updyke

Oh, poor babies.

Erin Welsh

All internal organs were affected. So you would have necrotic adrenal glands, dry brain tissues which indicated that-

Erin Allmann Updyke

Your brain dried out? Bro, if you didn't know this, your brain is literally sitting in a pool of fluid, it is not supposed to be dry.

Erin Welsh

The folds got all weird and the brains dried out. Torn or degenerated muscles associated with coughing.

Erin Allmann Updyke

You cough so hard that you rip your muscles of your diaphragm and stuff? Ugh!

Erin Welsh

Your ribs, yeah. And lungs that looked so bad upon autopsy that doctors compared their condition to pneumonic plague, which is the second most lethal form of Yersinia pestis plague, which causes death in 90% of its victims.

Erin Allmann Updyke

Don't worry, we're gonna have a two-part episode dedicated to the plague.

Erin Welsh

Yeah, we are. Or toxic gas.

Erin Allmann Updyke

Wow!

Erin Welsh

It destroyed the lungs. I mean, they would fall apart, it's horrifying. Horrifying. Here's another very unique symptom of the 1918 flu. Accumulation of pockets of air just beneath the skin. So that when a patient was turned over, to maybe change the bedding, their bodies would crackle.

Erin Allmann Updyke

What?

Erin Welsh

One Navy nurse compared the sound to Rice Krispies.

Erin Allmann Updyke

I was gonna say like Rice Krispies! (laughs)

Erin Welsh

She said she could never eat the cereal again.

Erin Allmann Updyke

Oh my god, I don't know if I can. Except, let's be real, I can definitely eat Rice Krispies.

Erin Welsh

They get way too soggy. Waste of time.

Erin Allmann Updyke

Rice Krispie treats. That's all I'm saying.

Erin Welsh

So, it was horrifying. Some people would come in, within a few hours, be dead. It was unheard of for a flu.

Erin Allmann Updyke

I mean, still to this day that's absolutely insane. Well, kind of, we'll see. Is it really? I don't know...

Erin Welsh

So what happened? This instance was not isolated at Devens, the extreme mortality. It spread globally, but was this the same virus that caused the first wave and if so, how did it pick up virulence? One hypothesis is antigenic shift. Erin, can you tell me a bit more about antigenic shift?

Erin Allmann Updyke

Yeah, you know, let's do that. Let's talk about the flu virus.

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(transition theme)

Erin Allmann Updyke

There's a couple of words that I want to define so that then we can sort of talk about the flu virus in general. So one of them you already mentioned, which is 'virulence'. And the other word is 'infectivity'. So I'm just gonna really quickly... Infectivity, for anyone who doesn't know, is essentially the percentage of people that are exposed to a disease that actually get infected. So it tells you how infectious and infectious disease actually is. So let's say I am sick with the flu and I cough on you, maybe you'll get the flu and maybe you won't. And infectivity determines how many people that I cough on will get the flu. Right?

Erin Welsh

Do different flu strains have different levels of infectivity?

Erin Allmann Updyke

Absolutely. Yeah. Absolutely. So clearly the 1918 flu was a particularly infectious strain, it was able to travel the globe. And in general, flu viruses are very infectious compared to something that's, say, sexually transmitted like something such as HIV. Okay, then virulence which is essentially if you do get infected, how likely is it that you're gonna get very, very sick and/or die. So that's what your virulence is. So this 1918 strain was both very infectious and extremely virulent, it was killing a ton of people.

Flu viruses, the Influenza virus, for - I don't know, I guess how many people are listening to this that don't know what a virus is? Let's just define it.

Erin Welsh

Let's define a virus.

Erin Allmann Updyke

Let's define it. We're starting from day zero. So, viruses are essentially just little bundles of genetic material surrounded by protein. Right. Viruses have proteins on their surface that our cells, our immune cells, use to recognize them. These proteins are called antigens, and we make antibodies to fight them.

Erin Welsh

Makes sense.

Erin Allmann Updyke

Makes sense. So flu happens to have two of these antigens, H and N. SO if you've heard of H1N1 or whatever-

Erin Welsh

Yeah, I have.

Erin Allmann Updyke

Okay, so that's what that actually means, is the proteins that are on the outside of the actual flu virus itself. It just so happens at there are 16 of those H proteins and 9 different versions of that N protein.

Erin Welsh

That's a lot of combinations.

Erin Allmann Updyke

Exactly. So the flu virus is what's called a retrovirus which is a type of RNA virus. That means the genetic material that makes up the flu is RNA, in humans it's DNA.

Erin Welsh

Gotcha.

Erin Allmann Updyke

RNA viruses and retroviruses especially have a really high mutation rate. They're so retro. Get it? Cause they're retroviruses? Like 1918?

Erin Welsh

Do retro people have higher mutations?

Erin Allmann Updyke

It's just like a funny joke. Play on words.

Erin Welsh

(laughs) Can we get a cricket sound, please? Thank you, Steven.

Erin Allmann Updyke

(laughs) So, what that means...A high mutation rate means that every time an Influenza virus replicates it might make a few mistakes that could result in small changes to those H and N proteins that make it harder for our body to recognize it. And this process, if you care about vocabulary, is called 'antigenic drift'.

Erin Welsh

Gotcha.

Erin Allmann Updyke

Now the other way that flu viruses can change which is even more dramatic is what's called 'antigenic shift'. Basically, the flu virus isn't just a single strand of RNA, it's a bunch of short strands. So if, for example, as often happens, an unlucky pig or unfortunate bird is infected with not one but two different strains of flu-

Erin Welsh

Like H1N1 and H3N3?

Erin Allmann Updyke

Exactly. Those can, inside the bird or the pig, mix and match and recombine to make like, H1N3 or H3N1. And this is what makes it really hard for our immune system to actually respond.

Erin Welsh

And so that is shift, that's a major change; and drift is small changes which are less scary.

Erin Allmann Updyke

Exactly!

Erin Welsh

And so antigenic shift, then, is what is theorized as to have happened in the 1918 second wave pandemic. One of the reasons that they think that this is the case, that is was antigenic shift rather than a completely new virus is that a lot of the people who were infected during the first wave showed immunity or partial immunity to the second wave.

Erin Allmann Updyke

Oh, so that makes sense.

Erin Welsh

That makes sense. So now we've got this horrifyingly virulent virus that is wreaking havoc in the military, in the U.S.-

Erin Allmann Updyke

Just raging.

Erin Welsh

In France, in England, in Germany, and it doesn't stop there. It spills over into the public and there it's even worse. A lot of the anecdotes that I'll be mentioning in terms of the pandemic spread take place in the U.S., and that's just because one of the books that I read concentrated on this pandemic in the U.S.

Erin Allmann Updyke

Right, it doesn't mean that these weren't also happening all over the world.

Erin Welsh

The globe was affected by this and a lot of areas were hit harder than the U.S. So from Camp Devens the virus, more deadly this time, exploded across the U.S. And so one of the places I'll take about it Philadelphia. Philadelphia was hit extremely hard, partly because the lead public health official at the time refused to cancel parades.

Erin Allmann Updyke

Typical.

Erin Welsh

Saying that public moral was more important than...And he was like, 'Oh no, the flu's not a problem.'

Erin Allmann Updyke

Oh no, yeah. And what's important is that for the flu virus, you become infectious, that is you start shedding virus out of you - like coughing, sneezing, whatever - before you actually show any symptoms.

Erin Welsh

So that means that you could be a happy-go-lucky-

Erin Allmann Updyke

Seemingly healthy-

Erin Welsh

-25 year old woman at this parade, waving a banner. Meanwhile, coughing-

Erin Allmann Updyke

Not even coughing.

Erin Welsh

Just breathing, hugging people-

Erin Allmann Updyke

Ugh, kissing people? With the mouth? And just spreading flu virus. And so that's a really, really important aspect of the flu is that you are infectious before you ever show symptoms. And so that's why it's very, very easy to spread because you have these people, like you said, at a parade that seem to be perfectly healthy so you're not afraid of them like you might be of someone who's coughing. You might avoid a person who's coughing because you think 'I don't want to get sick', but you don't avoid people that seem healthy because why would you?

Erin Welsh

Right. And so at this massive parade in Philadelphia which was not shut down against the advice of virtually every other public health official and physician, within 2-3 days after it, the number of flu cases exploded in Philadelphia to be in the 1000s.

Erin Allmann Updyke

Oh my god.

Erin Welsh

On one October day in Philadelphia, 759 people died of Influenza. In one day.

Erin Allmann Updyke

One day. In one city!

Erin Welsh

In one city.

Erin Allmann Updyke

That's insane.

Erin Welsh

Prior to this outbreak of Influenza, all deaths in the city averaged 485 per week. All deaths for all causes.



Erin Allmann Updyke

Oh my god.

Erin Welsh

So it was extraordinarily bad.

Erin Allmann Updyke

Yeah. I mean sounds pretty terrible.

Erin Welsh

It was extraordinarily deadly. The other terrifying thing about the Influenza pandemic-

Erin Allmann Updyke

Tell me, tell me.

Erin Welsh

-is that the people that were hit the hardest were not the people who are usually hit by Influenza. So usually the Influenza mortality curve, where you would have on the y-axis the number of deaths and on the x-axis you would have age in years, so with 0 at the far left end and let's say 100 at the far right end, normal Influenza/seasonal Influenza you see a U-shaped graph. Where you see mortality peaking in infants and in the elderly.

Erin Allmann Updyke

Right. Old people and babes.

Erin Welsh

Old people and babes. With the 1918 pandemic, that U was turned upside down so it was actually inverted, where you see the highest mortality rates among people...The highest was in the group between the ages of 25-29, followed by 30-34, and then 20-24. So it hit hardest the groups of people that are normally completely resilient, healthy, young, robust.

Erin Allmann Updyke

So how did this happen? Was it all just because it was a new virus? I mean...

Erin Welsh

So there are a couple different ideas. One is that the elderly were protected because they had been exposed to a similar virus in their youth. It doesn't match up to some of the other previous epidemics, but that still could be the case. Another theory is that young people also had very healthy immune systems, so that by the time the virus had invaded all of their lungs, the immune response that their bodies mounted was so severe that it was that that actually killed the people.

Erin Allmann Updyke

I am shook. (laughs)

Erin Welsh

(laughs) Does that makes sense?

Erin Allmann Updyke

Yeah, so you're saying that because they had such a great immune system, essentially, that all of the stuff that your immune system - which we're not gonna get into because it's too technical - but all of the stuff that is released during that immune response essentially is what actually killed them and not the virus itself.

Erin Welsh

Right, exactly.

Erin Allmann Updyke

Wow, we're like penalized for being good at stuff. Typical young people.

Erin Welsh

So it was devastating and bizarre. And it caused a lot of panic, it caused a lot of laws to be enacted such as anti-spitting laws.

Erin Allmann Updyke

Okay, that's probably a good law though.

Erin Welsh

Yeah you shouldn't spit on people anyway, but...

Erin Allmann Updyke

But, so if your city has an anti-spitting law, it's probably because of the 1918 flu?

Erin Welsh

It probably is.

Erin Allmann Updyke

That's awesome.

Erin Welsh

Somebody was killed because they spat.

Erin Allmann Updyke

Wait, like somebody got infected because they were spat on?

Erin Welsh

No, no, I'm sorry. Somebody, a policeman - I need to fact check this, but let's just say that it's fact. A policeman killed an individual for spitting in the streets in San Francisco. It was taken very seriously. You could not go outside without face masks, but at the same time the public health advice was very influenced by the fact that the U.S. was at war, so it was 'keep morale up'. The ways to avoid the flu were to not talk about the flu.

Erin Allmann Updyke

Oh, no.

Erin Welsh

Yup. So this was the genius idea of the same guy who decided to go on with all the parades in Philadelphia.

Erin Allmann Updyke

Oh god.

Erin Welsh

Don't talk about the flu, drink alcohol probably, and cheer for your country. With this devastation going on in the youngest and healthiest populations, the race was on to try to find a cure and the causative agent. For a really long time the causative agent of Influenza was not known and the biggest contender was this bacterium called haemophilus influenzae, which was found in a lot of flu patients.

Erin Allmann Updyke

Right.

Erin Welsh

But it wasn't actually that.

Erin Allmann Updyke

Oh, obviously, because we know now that it's - but how did we figure that out? I mean, 1918, we didn't have a lot of technology, right?

Erin Welsh

Right. It took a really long time. And so it wasn't actually until a few years ago, like in the past 10-15 years was it conclusively shown that the 1918 flu was actually an Influenza virus.

Erin Allmann Updyke

How'd they do that?

Erin Welsh

Well, I'll tell you. A bunch of scientists went up to Alaska-

Erin Allmann Updyke

Probably put their glasses on, cause scientists all wear glasses. (singing) Stereotype!

Erin Welsh

And lab coats. PPE. Personal Protective Equipment.

Erin Allmann Updyke

That's not a stereotype, that's important.

Erin Welsh

That's really important. Got out ethics training down.

Erin Allmann Updyke

(laughs)

Erin Welsh

So a bunch of scientists went up to Alaska where there were graves in the permafrost from the 1918 flu victims, and the fact that it was in permafrost means that the conditions were such that the bodies could be preserved a lot longer and so the RNA in the viruses didn't degrade as much.

Erin Allmann Updyke

Right, that's so cool!

Erin Welsh

Super cool. So then they actually dug up some bodies-

Erin Allmann Updyke

I hope they had permission from their relatives.

Erin Welsh

Got permission, I should've said got permission to dig up some bodies, and took out lung tissue in some of the victims. And from that isolated the RNA virus, the Influenza virus, that caused the 1918 flu. They sequenced it and they recreated it.

Erin Allmann Updyke

Are you serious!?

Erin Welsh

So in a lab they recreated the 1918 strain of flu virus that killed 50-100 million people. Wait for it. They infected monkeys with it and the monkeys died in a very similar way that the young victims of the 1918 flu virus did, which was their immune system just going crazy at the flu virus.

Erin Allmann Updyke

Poor little monkeys.

Erin Welsh

Poor little monkeys. But this also brings to mind the ethical dilemma of such work. And I'm not talking about testing animals, that's for another episode.

Erin Allmann Updyke

No, that's a separate ethical dilemma.

Erin Welsh

Right. But we're talking about the bioterrorism impact. So when you have this viral genome sequenced, you can publish it. It's basically a recipe.

Erin Allmann Updyke

You actually have to publish it. There are requirements that when you...I don't know if this is boring for people but if you sequence something novel you have to publish it in a publicly available database. So yeah, in theory anybody with enough knowledge and access to laboratory equipment could make it and disseminate it and it's been long enough since 1918 that most of us probably aren't immune to that.

Erin Welsh

Right, except unless you got your flu shot. Every year the flu shot includes a number of different flu strains, as we talked about. And in 2009, actually, they included H1N1 variant of 1918.

Erin Allmann Updyke

Oh, of 1918? Shoot. I don't think I got my flu shot in 2009.

Erin Welsh

I don't think I did. But I mean, it probably has worn off by now anyway.

Erin Allmann Updyke

That's true, that's true. But that's really interesting. I love it! Because it wasn't H1N1 flu that caused that Swine Flu outbreak in 2009 that people were very worried about. I mean it turned out not to be as bad as it could've been, but wow, how interesting.

Erin Welsh

Yeah. By the end of the pandemic, which was pretty much over by Armistice, November 11th... I mean it swept through the globe and left devastation in its path. Like I said, 50-100 million people killed worldwide. Some of the areas, these are just some interesting statistics-

Erin Allmann Updyke

Yeah, hit me with them.

Erin Welsh

In the U.S., about 28% of people were infected. 675,000 people died. Today, that would be over 1,750,000 people.

Erin Allmann Updyke

Oh wow.

Erin Welsh

It would be devastating.

Erin Allmann Updyke

Oh my god.

Erin Welsh

But the U.S. escaped the mortality that a lot of other places saw.

Erin Allmann Updyke

So other places had it even worse than 675,000 people?

Erin Welsh

Yeah, there were entire villages in Alaska that were killed. Entirely. Everyone dead. Iran, between 8-21% of the population died.

Erin Allmann Updyke

If you can see my face right now, it's just like totally shocked.

Erin Welsh

The worst affected was German Samoa, which is now the Independent Republic of Samoa, with 90% of the population infected, 30% of adult males, 20% of adult females, and 10% of children dead.

Erin Allmann Updyke

Islands, man.

Erin Welsh

Islands.

Erin Allmann Updyke

It's just so easy to just spread through an entire island like that.

Erin Welsh

Especially if it hasn't been exposed to a similar Influenza virus. So it was truly devastating. And so one of the questions, though, because it had such devastation, it caused such high mortality but why didn't it leave its mark in American culture or literature or music or behavior? And the answer is, it probably did. But overall it didn't leave its mark the way some of the other pandemics have left as obvious a mark.

Some historians argue that the pandemic accelerated the end of WWI. The Central Powers were hit harder and earlier by the flu virus and so that weakened their forces and so they tried to negotiate peace talks earlier on than they had anticipated, because the Allies were hit later on.

Erin Allmann Updyke

Oh, wow. So we actually only won because we got sick later.

Erin Welsh

Because we got sick later. In one of the books that I read, some historians have theorized that Woodrow Wilson came down with the flu and it changed his mental state, which was shown in some other cases anecdotally in terms of being more aggressive, or just personality shift.

Erin Allmann Updyke

Like a permanent change. Whoa.

Erin Welsh

And he was way more withdrawn and way more argumentative and way more stubborn. And so the peace treaty, the armistice that was eventually negotiated and the peace treaties that were signed were much more severe towards Germany, the Central Powers, than they originally had planned on and so that could have contributed to the animosity which then built up events leading to WWII. Which is interesting.

Erin Allmann Updyke

Wow. That's insane.

Erin Welsh

Yeah, so this 1918 pandemic was enormous in scope, enormous in death toll, and we haven't seen anything like it since. In 24 weeks the flu virus killed more people worldwide than HIV has killed in 24 years.

Erin Allmann Updyke

Seriously?

Erin Welsh

Seriously.

Erin Allmann Updyke

That's...Seriously. Wow!

Erin Welsh

I should fact-check that because that statistic is from 2004.

Erin Allmann Updyke

Oh yeah we should definitely fact-check that then. But that's still a pretty shocking statistic.

Erin Welsh

I mean, it's terrifying to read about because this was only 99 years ago. We don't have treatments for viral infections that are as effective as we do for bacterial infections.

Erin Allmann Updyke

Right, right. Viruses are still much trickier little beasties and a lot of that has to do with what we were saying before about just how sneaky these viruses are and how mutable they are.

Erin Welsh

Right. So then the question I'll pose to you is how worried do we have to be about another 1918 pandemic? Flu pandemic?



Erin Allmann Updyke

It's a really great question. So let me say...Can I just say, 'You should be worried?' I mean I can leave it at that, but I'll elaborate.

Erin Welsh

But tell me why.

Erin Allmann Updyke

Okay, so the flu virus, being such a sneaky beastie, is something that obviously sort of circulates all the time, right? There are seasonal flu strains and probably every time that you go to your doctor between the month of September to January says, (old-timey voice) 'Would you like to get a flu shot? Have you had your flu shot yet?'

Erin Welsh

Do you go to a doctor in the 1920s?

Erin Allmann Updyke

Yeah, that's how much doctor voice is.

Erin Welsh

Does he work in a speakeasy?

Erin Allmann Updyke

(old-timey voice) He's like, 'I'll get yeah a tonic and a flu shot.' (laughs)

Erin Welsh

(laughs)

Erin Allmann Updyke

But the vast majority of those flu cases for anyone who doesn't get the flu shot are pretty mild, right? You're probably miserable for a week, but you recover, you don't die unless you're an old person or a very young person or an immunocompromised person. But there is quite a lot of concern that a similar thing could happen as to what likely happened in 1918, that is a new strain that we have never previously seen - we being the human race - has never seen before. And if that were to happen, yeah we really could see something similar to what we saw in 1918.

If you were to ask most people who work and study infectious disease epidemics what they're most afraid of, I would put good money on betting that they would say H5N1.

Erin Welsh

H5N1.

Erin Allmann Updyke

Right, so H5N1 is Avian flu, Bird flu, have you heard of that?

Erin Welsh

Of course.

Erin Allmann Updyke

Right, most people have heard of it. If you haven't, you're hearing about it now so you'll be ahead of the curve. The Avian flu is a particular strain of virus that circulates in wild waterbirds, ducks, geese, etc. many of which are migratory. It can also circulate in domestic fowl, so chickens and domestic ducks. And the reason that it is so scary is that it has been spilling over to humans.

Erin Welsh

What does that mean exactly, 'spilling over'?

Erin Allmann Updyke

So, 'spillover' is the term that we use when an infectious disease that normally circulates only in animals begins to infect humans.

Erin Welsh

Could that be something like Ebola?

Erin Allmann Updyke

Absolutely. We'll talk about that in a future episode, don't worry. But yeah, absolutely, Ebola is a very good example of a disease that is usually caused by spillover from animal populations into humans.

And same thing with H5N1. So this is a virus that usually circulates in wild birds, often spills over into domestic birds, and from those domestic birds it's easy for it to then spillover one more time into the human population. And it has done this a number of times. The very first time that this happened was in 1996 or 1997. 1997 was the first human case. It happened in Hong Kong, it was a little boy and he died. And he became the first known human case of H5N1. There were a number of other people, 17 other people in fact, that became infected around that exact same time in Hong Kong and five of those people died.

Erin Welsh

But those are very small numbers that you're telling me, so does this mean...Why wasn't there a pandemic? Why wasn't this larger?

Erin Allmann Updyke

Okay, so I can hit you with some slightly scarier numbers.

Erin Welsh

Hit me.

Erin Allmann Updyke

So that was 1997. We're now in 2017, that's 20 years later. This bird flu, H5N1, has spilled over from domestic animals into humans in 16 different countries. It has infected 859 people, according to the most recent estimates by the World Health Organization, and of those 859 cases, 453 of them died. That's a 52% mortality rate.

Erin Welsh

Holy moly.

Erin Allmann Updyke

52%. That's why this virus is so terrifying. So it's true that most of these are what you might want to call isolated cases, maybe...

Erin Welsh

Were humans the dead-end host? Was there human to human transmission?

Erin Allmann Updyke

Right, so that's the big question. And in many of these outbreaks we do see evidence of human to human transmission. And this is something that for a long time - there's been a lot of politics around this - and for a long time various governments were refusing to recognize that human to human transmission was actually happening. But in many of these cases, human to human transmission is definitely happening. It is at much lower levels than what we normally see with a human flu virus.

Erin Welsh

So the infectivity is lower.

Erin Allmann Updyke

Exactly.

Erin Welsh

And so, the issue with the government. Is that because when H5N1 was found in a bird population they would cull the entire...?

Erin Allmann Updyke

Well yes and no. That's sort of common practice and that started because of that initial outbreak that happened in Hong Kong. Hong Kong actually culled millions of birds and they have since kept infections very much at bay on the island of Hong Kong. Other countries have tried to do the same but the issue is that in many of the countries where these spillovers are happening, it's small farmers who have these bird flocks. And so you're basically destroying their livelihood by coming in and culling all of these infected birds. So farmers don't want to cooperate and the government doesn't want panic, which tends to happen when you say something like, '52% of people are dying from a pathogen that we don't have control over'.

Erin Welsh

So I understand that the government doesn't want panic but we kind of saw how that panned out in the 1918 flu.

Erin Allmann Updyke

Yeah, isn't it amazing how humans just never learn our lesson?

Erin Welsh

But then there was the Ebola scare. I mean, I think it's a combination of not wanting to panic people, which is understandable because then people might do crazy things, but then also a lack of scientific understanding about transmission. So whereas the Ebola scare was not warranted for people in the U.S. but this is warranted.

Erin Allmann Updyke

In some cases, yeah. But there hasn't been extensive human to human transmission yet. Extensive meaning, you know, we haven't seen a pandemic yet. But there certainly has been limited human to human transmission. So maybe one person going home and infecting his entire family, for example. But maybe not infecting an entire village or an entire town or something like that. But that is sort of the biggest fear, is that this virus has spilled over so many times that eventually it's gonna break that last barrier and it's going to be able to be transmitted freely between humans, in which case we could absolutely see a global pandemic.

Erin Welsh

But one difference between now and 1918 is technology for vaccine creation.

Erin Allmann Updyke

Absolutely.

Erin Welsh

How does that play into this?

Erin Allmann Updyke

So every year virologists try to predict what's going to be the most common circulating strains of flu. Right? And they do a lot of models to figure out what strains those are and then they make a vaccine for it and that's the seasonal vaccine that you get. This virus, we can't quite make a vaccine for yet because it doesn't quite exist yet in a form that would be passing human to human. So we wouldn't be able to make a vaccine for it until it already is circulating, if that makes sense.

So we don't have a vaccine for H5N1 for humans. We do have a vaccine for domestic birds, and so a lot of places are trying to vaccinate domestic birds so that we don't have that initial spillover event happening in the first place. But that's sort of an imperfect system as well.

So another big difference between 1918 and today is that today you can get on a plane in Chicago and be in Hong Kong tonight, get on a plane there and be in Australia the next day. So our mobility is insanely huge. So the chances that if something like this were to happen that it would spread worldwide extremely quickly are very, very high. Which is something that concerns a lot of people who study this.

So to answer your initial question which is how scared do you need to be about this kind of thing happening today? Go ahead and get your seasonal flu shot, wash your hands, and just be a little bit afraid, I guess.

Erin Welsh

Be a little afraid.

Erin Allmann Updyke

Not too afraid. Don't hang around birds. That would be a good piece of advice I have for you. Don't hang around birds.

Erin Welsh

Be aware of the symptoms of flu and educate yourself.

Erin Allmann Updyke

Don't be afraid to go to the doctor. Cause that happens a lot and then you can end up infecting family members or friends.

Erin Welsh

If you're feeling sick, don't go to work.

Erin Allmann Updyke

Oh my gosh. And don't come to class!

Erin Welsh

Oh god, please don't come to class. Don't go to the library, don't cough on me on the bus.

Erin Allmann Updyke

Don't touch all the doorknobs.

Erin Welsh

Cough into your elbow! I think we're being too preachy now.

Erin Allmann Updyke

We're definitely being too preachy.

Erin Welsh

We can cut all of this.

Erin Allmann Updyke

Yeah, we can.

Erin Welsh

Well, I don't think I have anything that I wanna add.

Erin Allmann Updyke

How do we close this out?

Erin Welsh

Um, we say, uh...

Erin Allmann Updyke

Oh! Thanks for listening.

Erin Welsh

Thanks so much.

Erin Allmann Updyke

Make sure that you rate, review, and subscribe.

Erin Welsh

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Erin Welsh

If you want to learn more, we have a number of books and articles that we are going to hit you with right now.

Erin Allmann Updyke

Yeah, we encourage you to read.

Erin Welsh

Some of the books that we focused on were:

'The Great Influenza' by John Barry; which is super interesting, really well researched, great book.

Erin Allmann Updyke

All about the 1918 flu, specifically.

Erin Welsh

Right, and it focuses mostly on the effects in the United States.

'Flu' by Gina Kolata is more focused on the discovery of the actual flu strain that caused the 1918 flu. So how it was isolated and then sequenced and so on.

'Pale Rider' by Laura Spinney is another non-fiction book about the 1918 flu and this deals more with personal histories and accounts and this has a much more global feel to it.

Erin Allmann Updyke

And then if you're interested in learning more about the Avian Influenza and you want to be scared shirtless, like seriously, you can read:

'Fatal Strain: On the Trail of Avian Flu and the Coming Pandemic', and that's by Alan Cypres, it's a really interesting book.

Thank you to Bloodmobile for the music and to Miles for all of your help with our logo.

Erin Welsh

Thanks for listening!

Erin Allmann Updyke

Bye!

TPWKY

(transition theme)