

Erin Allmann Updyke

"John was a well-nourished, playful, and cooperative child with no history of developmental problems according to the admitting nurse. John was admitted to the hospital because he had developed an ear infection but that was easily treated. In the ensuing months John returned periodically to the clinic for treatment of his chronic earaches but by the time he was two years old he had developed symptoms that were not at all routine.

In May 1941 his parents rushed him to the hospital. A few hours earlier he had bent over to the left and couldn't straighten up, they told the admitting nurse. And since that time he had been acting crazy-like. John had been eating plaster they said and the previous day he had eaten some paint. At the hospital he fell to the left side when he tried to walk and he reeled around to the left. He didn't respond to his name or questions. The hospital raised the possibility that John suffered from lead poisoning, encephalitis, and secondary anemia. The blood work showed 390 mcg of lead per deciliter of blood, almost 80 times the level considered by the CDC to be dangerous for children 70 later and at the time clearly a cause of acute poisoning. When told that paint from the windowsills was dangerous his mother said she had not realized its danger and had caught him on frequent occasions with a mouthful of paint chips. She promised that in the future she would make every effort to keep the child away from the paint.

In mid June 1941 after more than a month in the hospital, John's symptoms subsided and he was sent back home but two months later the mother was back at the social service department. In the words of the social worker, the family had contacted the real estate agency several times about repair work but with no success. There continued to be problems of loose plaster throughout the home in spite of their efforts at repair. The social worker contacted the health department which promised to investigate the home conditions but we know neither the results nor what befell John in subsequent years."

TPWKY

(transition theme)

Erin Welsh

Wow.

Erin Allmann Updyke

Yeah. That's so sad.

Erin Welsh

Yeah, it really is.

Erin Allmann Updyke

Unfortunately not uncommon.

Erin Welsh

Oh no, that's like one story of millions.

Erin Allmann Updyke

Yep, yeah.

Erin Welsh

So what was that from?

Erin Allmann Updyke

That was from the book 'Lead Wars'.

Erin Welsh

Hi, I'm Erin Welsh.

Erin Allmann Updyke

And I'm Erin Allmann Updyke.

Erin Welsh

And this is This Podcast Will Kill You.

Erin Allmann Updyke

And today we're talking about-

Erin Welsh: Lead poisoning.

Erin Allmann Updyke: Lead poisoning.

Erin Welsh: Yeah, it's a huge topic.

Erin Allmann Updyke: Don't we say that every single time? Yes, we do.

Erin Welsh: We absolutely do.

Erin Allmann Updyke: Is it always true?

Erin Welsh: It always is. Yeah, I'm excited for this one though.

Erin Allmann Updyke: We also say that every time and it's also true every time.

Erin Welsh: I know! This is genuine, people. It really is. Okay well it's also quarantini time.

Erin Allmann Updyke: Quarantini time.

Erin Welsh: That's right. What are we drinking this week?

Erin Allmann Updyke: Today we're drinking The Fall of Rome.

Erin Welsh: We are. And it's named that for reasons that I will tell you later on in the episode.

Erin Allmann Updyke: Yes, it will become quite clear if you can't figure it out already.

Erin Welsh: And what is in The Fall of Rome?

Erin Allmann Updyke: It's basically a sangria.

Erin Welsh: It is. So it's red wine, brandy, cut up oranges, lemons, green apples, and then a cinnamon stick tossed in there and maybe serve it over ice with a splash of club soda.

Erin Allmann Updyke: Try to avoid lead-lined mugs.

Erin Welsh: Yes, please avoid lead-lined mugs.

Erin Allmann Updyke: We will post the full recipe for our quarantini as well as our nonalcoholic placeborita version on thispodcastwillkillyou.com as well as all of our social media channels.

Erin Welsh: Yeah.

Erin Allmann Updyke: We have merch including shirts, mugs - not lead-lined.

Erin Welsh: Nope. Pins.

Erin Allmann Updyke Soap, etc.

Erin Welsh Yeah.

Erin Allmann Updyke All these are available from our website, just click on MERCH.

Erin Welsh That's it.

Erin Allmann Updyke Let's just talk about lead poisoning, shall we?

Erin Welsh Let's do it.

Erin Allmann Updyke Okay, all right.

Erin Welsh But first let's take a little break.

TPWKY (transition theme)

Erin Allmann Updyke All right so lead. Everyone knows what lead is, right?

Erin Welsh I mean it's a metal.

Erin Allmann Updyke It's a metal, okay. Episode over. (laughs)

Erin Welsh Cool.

Erin Allmann Updyke Just kidding. Lead is a heavy metal, it's an element on the periodic table, Pb, that's it's name. I assume you're gonna say why, right Erin?

Erin Welsh I'm very excited about it actually.

Erin Allmann Updyke Excellent. Good, cause I'm not gonna say why. And I've done a lot of biochem on this podcast but never have I had to do pure chemistry before.

Erin Welsh Ooh, fun.

Erin Allmann Updyke I'm not gonna do it, Erin.

Erin Welsh Oh, Erin!

Erin Allmann Updyke I can't, I don't know enough chemistry to be able to explain it well, okay?

Erin Welsh Okay.

Erin Allmann Updyke We're just gonna talk today about what happens once lead gets into your bodies, okay?

Erin Welsh That seems like chemistry to me but sure.

Erin Allmann Updyke

Sure. It doesn't feel like chemistry.

Erin Welsh

Okay.

Erin Allmann Updyke

In our bodies lead, the element, exists as what's called a cation. That means that it's a positively charged molecule. Okay? So as it floats around through our bloodstream it's floating around as a single molecule that is positively charged. Because it has a positive charge it's attracted to other things in our blood that are negatively charged. If you think of something like a magnet where you have a positive and a negative pull-

Erin Welsh

Yeah.

Erin Allmann Updyke

It's just like that inside of our bodies, positive things are attracted to negative things and vice versa. Okay. So in our bodies it turns out that one of the things that is negatively charged are proteins, okay.

Erin Welsh

Oh! All proteins?

Erin Allmann Updyke

Yeah, pretty much. Proteins are negatively charged, they have an end group that is negatively charged. And so lead in our bodies tends to bind to proteins.

Erin Welsh

That's really interesting. Also I feel like I should have known that all proteins were negatively charged and now I'm embarrassed but hey, you know what-

Erin Allmann Updyke

You don't have to be embarrassed, Erin, there's always things to learn.

Erin Welsh

Yeah. Always things to forget too.

Erin Allmann Updyke

(laughs) So a lot of the toxicity of lead poisoning is because lead ends up binding to proteins and screwing up the way that they function.

Erin Welsh

Makes sense.

Erin Allmann Updyke

That's kind of the basic pathophysiology of it.

Erin Welsh

Okay.

Erin Allmann Updyke

The other thing is that because essentially all lead is - I know it's kind of hard to think of lead as just this positively charged molecule because when you think of a metal it's like a piece of metal, right?

Erin Welsh

Right.

Erin Allmann Updyke

But in our bodies it's just a tiny little ion and because it's so tiny and because it's charged it can pass freely across a lot of membranes very easily.

Erin Welsh

Oh okay.

Erin Allmann Updyke

Okay.

Erin Welsh

Which is also bad news.

Erin Allmann Updyke

Very bad news because it's not supposed to be in our bodies. Okay so what I'm gonna do first, now that you know the very basics of how lead can end up causing problems in our body, it binds to proteins and it can cross membranes, we're gonna first talk very quickly about what it might look like if somebody say came to the emergency room or their doctor, what are the kinds of symptoms that might make someone think hey this could be lead poisoning. And then we'll talk about exactly how each of those symptoms might happen.

Erin Welsh

Okay.

Erin Allmann Updyke

All right. So the common symptoms that might make someone think we're looking at lead poisoning are things that are actually pretty general. Abdominal pain, especially very severe abdominal pain, joint pains, severe headache, you might have increased intracranial pressure which means increased pressure in your cranium, in your skull, and then neurotoxic effects which we'll talk in more detail about, anemia, and kidney dysfunction.

Erin Welsh

Okay and so these things could all happen at once or over the period of weeks or what is the timescale?

Erin Allmann Updyke

Great question, the timescale kind of depends on the timescale of exposure.

Erin Welsh

Okay.

Erin Allmann Updyke

So a lot of these symptoms you might not see until blood lead levels - that's gonna be so hard to say for this whole episode, by the way.

Erin Welsh

Well is it as hard as Giardia?

Erin Allmann Updyke

Yes, maybe harder. (laughs) But until blood lead levels are above about 60, that's when you might see some of these acute symptoms like abdominal pain and joint pains. But lead is something that can build up in your body slowly over time or you could be exposed to a large amount in a short period of time so it kind of just depends on what your exposure is and where you were exposed.

Erin Welsh

Okay.

Erin Allmann Updyke

Okay. So we talked about those general symptoms. One of the big things that we see in lead poisoning and even though it's probably not the most detrimental or acutely important is anemia. Anemia means low blood count, so low red blood cells, okay, not enough red blood cells. Your red blood cells are what carry oxygen so that's pretty important.

Erin Welsh

Right. We've talked about it in hookworm, I think.

Erin Allmann Updyke

Yeah, we totally did, for sure.

Erin Welsh

Yeah.

Erin Allmann Updyke

And in hookworm it's totally different cause your losing blood.

Erin Welsh: Right.

Erin Allmann Updyke: What happens in lead poisoning is that lead actually blocks the action of an enzyme, remember that enzymes are proteins and lead is binding to proteins, it binds to and blocks the action of an enzyme that is essential for the synthesis of hemoglobin.

Erin Welsh: Oh.

Erin Allmann Updyke: Yeah, hemoglobin is what's in your red blood cells that actually carries the oxygen. So if you can't make hemoglobin then you can't make red blood cells, then you can't carry oxygen and you're anemic.

Erin Welsh: Okay. That's interesting.

Erin Allmann Updyke: Yeah. It also ends up leading to a number of different problems down the line where it can cause kidney dysfunction both because it's messing up hemoglobin synthesis and because it actually can deposit in the tubules of your kidneys and cause direct damage to your kidneys.

Erin Welsh: Yikes.

Erin Allmann Updyke: Now your kidneys as it turns out are really important in regulating your blood pressure.

Erin Welsh: Right.

Erin Allmann Updyke: So if you start messing with your kidneys you can end up causing your kidneys to raise your blood pressure in your body.

Erin Welsh: Why does it raise the blood pressure?

Erin Allmann Updyke: Great question. So your kidneys, the way that they interact with your blood pressure is when your kidneys sense low blood flow they release a hormone that tells your brain, 'Hey, we've got low blood flow. You need to increase the blood pressure.'

Erin Welsh: Oh!

Erin Allmann Updyke: And so yeah, syphilis the damage that lead can cause to your kidneys reduces the flow of blood through your kidneys and that releases hormones that says, 'Hey, the blood pressure's low, we need to constrict our vessels and increase this pressure.' But when in reality what ends up happening is then you have high blood pressure, hypertension.

Erin Welsh: Because it's not about blood volume, it's about these false signals.

Erin Allmann Updyke: Exactly, exactly.

Erin Welsh: Oh, cool. Okay. Interesting.

Erin Allmann Updyke: Yeah. Okay so now we've talked about hemoglobin, we've talked about kidney dysfunction, we've talked about hypertension. That was so many things all at once.

Erin Welsh: Boom.

Erin Allmann Updyke

Another thing about lead is that so it's this charged molecule, right? It turns out it's functionally kind of similar to calcium. Calcium is also a charged molecule, a positively charged molecule. So lead can compete with calcium in our bodies. Where do you find calcium in our bodies, Erin?

Erin Welsh

Bones.

Erin Allmann Updyke

Bones. So lead can end up depositing in bones, it can deposit in joints, and it can disrupt the normal synthesis of bones. so this can cause joint pain, bone pain, and then also things like osteoporosis or osteopenia.

Erin Welsh

And that's how you can see lead poisoning in X-rays.

Erin Allmann Updyke

Yes! You see lead lines in X-rays. Now as we know it's a small, charged molecule, it can cross membranes. It can cross the placenta so in pregnant people with high lead exposure it can cause stillbirth or different types of malformations in the fetus. It also can cross the blood-brain barrier.

Erin Welsh

Classic.

Erin Allmann Updyke

Classic. So that means it interferes with our central nervous system, it does this in a whole bunch of different ways. So by binding to certain enzymes or certain proteins it can inhibit the release of important neurotransmitters, things that your brain releases to communicate with your body. It can increase the release of others, so it basically just completely messes up the normal functioning of your central nervous system. So some people with lead poisoning, a very classic sign are certain types of peripheral neuropathies, so nerve problems in your peripheral nervous system as well as your central nervous system. So you might have things like what's called wrist drop where you can't flex your wrist anymore or foot drop where you can't flex your foot anymore.

Erin Welsh

Yeah.

Erin Allmann Updyke

And so that means, you can imagine, it might lead to things like clumsiness cause your feet aren't working properly, weakness, in severe cases it can lead to paralysis, and once it gets into your central nervous system your brain can actually end up absorbing that lead directly which can lead to direct neurotoxicity on your brain cells.

Erin Welsh

That sounds pretty stinking bad.

Erin Allmann Updyke

It's pretty stinking bad, yes. Okay so in children this is especially bad.

Erin Welsh

Yeah.

Erin Allmann Updyke

Because it can end up interfering with the development of the nervous system.

Erin Welsh

Right.

Erin Allmann Updyke

So let's talk about children in more specific because both adults and children are susceptible to lead poisoning but children are especially susceptible. There's a number of reasons why. First of all in adults only about 1/10th of the amount of lead that you ingest through your mouth or your mucus membranes is actually absorbed in your GI tract. Only about 10%.

Erin Welsh: Okay.

Erin Allmann Updyke: Okay. If you inhale lead about 40% of that lead is absorbed through your lungs, so inhalation of lead is a lot worse than absorption.

Erin Welsh: Yeah.

Erin Allmann Updyke: But in children their guts, because they're not fully developed probably, actually absorb a much higher proportion of the lead that they ingest.

Erin Welsh: Oh.

Erin Allmann Updyke: So they're absorbing lead at a higher rate.

Erin Welsh: That's interesting.

Erin Allmann Updyke: So right off the bat they're at higher risk. But because kids are also kids they're more likely to like eat dirt that might be contaminated, to lick a lead paint wall.

Erin Welsh: Yeah. Just put their hands in their mouths.

Erin Allmann Updyke: Exactly, right. And so they're more likely to be exposed to lead in the first place and then they're absorbing more of what they're exposed to.

Erin Welsh: Oh wow. So my assumption was that it was just the behavioral risk was higher for children, I didn't realize it was also their bodies, like a physical higher risk category.

Erin Allmann Updyke: Erin, it gets even worse.

Erin Welsh: Oh no.

Erin Allmann Updyke: Yes. Because children's blood-brain barrier isn't fully formed lead is even more likely to make it into the central nervous system.

Erin Welsh: Oh my gosh, okay.

Erin Allmann Updyke: And because their central nervous system is still developing on a cellular level they're more susceptible to the effects of lead on their nervous system's cells.

Erin Welsh: So it's like a lot more permanent damage can be done.

Erin Allmann Updyke: Exactly, yeah.

Erin Welsh: Yeah.

Erin Allmann Updyke: It also distributes in their body tissues differently so it's more likely to go into soft tissues than it is to bones in children vs adults. And that probably also has to do with just the differences in water and fat content in babies vs adults and things like that.

Erin Welsh

Okay.

Erin Allmann Updyke

Yeah.

Erin Welsh

I have a question. What is considered a child? Like at what point do they become no longer at a high risk category? I assume it's a spectrum, right, with certain ages being of higher risk but...

Erin Allmann Updyke

Yeah. That's a really good question. So in looking into this a lot of the data looks at children who are school-aged because that's when you can start to see some of the behavioral and neurocognitive issues that can develop. But lead exposures in children tend to be highest when they're about 2 years old or less.

Erin Welsh

Okay.

Erin Allmann Updyke

So that's when exposure risk is the greatest is when they're very little cause that is when they're toddlers and putting things in their mouths and stuff like that. But that's a good question in terms of like your brain isn't fully developed until after you're a teenager so presumably the effects in that you're susceptible effect-wise would continue through young adolescence.

Erin Welsh

Okay.

Erin Allmann Updyke

But the exposure is gonna be a lot less in that age group.

Erin Welsh

Okay, gotcha.

Erin Allmann Updyke

That's a really good question, though. Okay so while the early symptoms of lead poisoning or the acute symptoms of lead poisoning in children might be similar to adults where they'll have things like abdominal pain, joint pains, clumsiness, staggering, things that we heard in the firsthand account, once the brain is involved it can get a lot more serious and a lot more long lasting in children. Because if a child is exposed to high levels of lead, once the brain is involved it can progress to loss of consciousness and eventually death. If they survive though they often have lasting cognitive impairments. And what we have found that has taken unfortunately too long is that even at very low levels, chronic exposure can also cause these kinds of cognitive impairments.

Erin Welsh

Right, there is no safe level.

Erin Allmann Updyke

There is no safe level. Exactly, Erin. There's also some interesting research into what happens. So in your bloodstream lead only lasts for about 35 days, that's the half-life of lead in your blood is about 30 days, so your kidneys actually are helping to excrete lead. But once it deposits in your bones, the half-life is like 10-20 years.

Erin Welsh

Oh my gosh.

Erin Allmann Updyke

Yeah. So if you're exposed to very high levels of lead while you're young and it ends up depositing in your bones, it can be many years later where that lead sort of slowly leaches out of your bones.

Erin Welsh

And then once it leaches out of your bones, then it's still in your body.

Erin Allmann Updyke

It goes into your bloodstream and from there it can potentially still cross the blood-brain barrier and end up affecting your brain.

Erin Welsh

Wow.

Erin Allmann Updyke

Yeah.

Erin Welsh

So could you as a child have been exposed chronically to lead and then you only see it 20 years from then?

Erin Allmann Updyke

Great question, Erin. There's now some research being done where it seems like elevated lead in elderly people that were exposed when they were young, like people who are elderly now who were exposed to high levels of lead when they were young because it used to be that pretty much everyone was being exposed to high levels of lead, can actually lead to cognitive decline and dementia in elderly people.

Erin Welsh

Wow. Because it's finally leaching out of their bones into their blood-brain barrier or crossing the blood-brain barrier.

Erin Allmann Updyke

Exactly.

Erin Welsh

Oh my gosh. Holy cow.

Erin Allmann Updyke

Yeah, yeah. So yeah, that's lead poisoning biology-wise.

Erin Welsh

Wow.

Erin Allmann Updyke

We do have treatment but really the treatments that we have, it's called chelation therapy where you basically either orally or through IV give drugs that help to bind up the lead so that it doesn't cross your membranes and get into your organs and you can just excrete that lead. It really only tends to work if your blood lead levels are quite high, like 40 or 60.

Erin Welsh

Okay so if you do chelation and your blood levels are 15, then-

Erin Allmann Updyke

It doesn't seem to do much from what I have read.

Erin Welsh

Okay, okay.

Erin Allmann Updyke

Yeah. And what else happens is if you have very, very high levels of lead in your blood that doesn't reflect your total body concentration of lead. So even for example like the child John in the firsthand account who had 390-

Erin Welsh

Outrageous.

Erin Allmann Updyke

That is outrageously high. Once you give chelation therapy, that will reduce your blood lead levels but then over time it will start leaching out of your organs and your bones where it has already deposited and your blood lead levels will rise again to sort of equilibrate.

Erin Welsh

Right.

Erin Allmann Updyke

And then you might have to chelate multiple times which is probably why he was in the hospital for so long.

Erin Welsh

Yeah. Wow.

Erin Allmann Updyke

Yeah so the most important thing to do with lead poisoning is to eliminate the source of exposure to begin with, figure out where someone was exposed and try to stop that exposure and prevent it from happening in the first place.

Erin Welsh

Yeah well, yeah. I'll get into it.

Erin Allmann Updyke

Yeah, yeah. So yeah, that's the biology of how lead really does a number on your body.

Erin Welsh

It really does.

Erin Allmann Updyke

Yeah. So Erin, how did it get here? What the heck?

Erin Welsh

Great question. Let's take a short break.

Erin Allmann Updyke

Okay.

TPWKY

(transition theme)

Erin Welsh

Lead. This was a really interesting episode to research because it was so different than what we usually do.

Erin Allmann Updyke

Oh my gosh, yeah.

Erin Welsh

Like instead of reading about the evolutionary origins of this or that bacterium or virus or something, I got to read about how humans used a metal in different ways throughout history.

Erin Allmann Updyke

Oh that's cool.

Erin Welsh

Yeah, and what that meant for their health. Okay, let's get started. So it turns out that lead is one of the longest used metals, like it's been around for ages. There's no lead age like there is an Iron Age or a Bronze Age but lead was used during all of these metal ages. And the reason that there wasn't a specific lead age is because it's not a very sexy metal, like it didn't really cause a revolution I guess or a huge change.

Erin Allmann Updyke

(laughs) That's our title, 'Lead: Not a Very Sexy Metal'.

Erin Welsh

Not a very sexy metal. (laughs) Lead is soft and dull and so people didn't really wanna use it in jewelry or decoration or making weapons. Instead lead was used to carry out some of the grunt work like plumbing, architecture, etc. especially in Greek and Roman times. And it was also used for pigments going back to the paleolithic times.

Erin Allmann Updyke

Wow!

Erin Welsh

It's been around since before people could write about lead.

Erin Allmann Updyke

Yeah I mean it's just a part of our earth so that makes sense but wow, it's so interesting that humans were using it for so long.

Erin Welsh

So long. Okay how about some etymology real quick?

Erin Allmann Updyke

Yes!

Erin Welsh

I think this might be one of the most exciting etymology things that we've done on this podcast for me, I don't know. Okay this is not really etymology but... So first of all the use of lead was so widespread in ancient times that there's even an Egyptian hieroglyph for lead.

Erin Allmann Updyke

What?

Erin Welsh

Isn't that cool?

Erin Allmann Updyke

Yeah.

Erin Welsh

Okay but etymology. So as you mentioned the chemical symbol for lead is Pb, capital 'P', lowercase 'b'. And that actually comes from the Latin plumbum which actually has older roots even in some pre-Hellenistic language so like pre-Greek. And plumbum was used to refer to basically any metal that was silvery, had a low melting temperature, and was easily oxidized. And these are the characteristics of lead along with tin, zinc, and some other metals and alloys. To distinguish from the rest of those metals though, lead was often called white lead so people could distinguish them.

Erin Allmann Updyke

Okay.

Erin Welsh

But the word 'plumbum', does that sound like anything to you?

Erin Allmann Updyke

Like plumbing!

Erin Welsh

Yes and plumber.

Erin Allmann Updyke

Yeah.

Erin Welsh

Lead was used in Roman water pipes, so that's how plumbing and plumber got their names.

Erin Allmann Updyke

Oh man, I never even put that two and two together.

Erin Welsh

I know!

Erin Allmann Updyke

Wow.

Erin Welsh

So plumbing refers to the actual metal which was lead that was used to construct those pipes.

Erin Allmann Updyke

Wow.

Erin Welsh

Isn't that...like my mind just like dropped out of the back of my head.

Erin Allmann Updyke: Etymology is cool, bro.

Erin Welsh: Yeah, I love it. (laughs) And you can also find literary references to lead, most of them using lead to describe something being weighed down, like a heart of lead as well as expressions like, 'I'm gonna pump your guts full of lead'.

Erin Allmann Updyke: (machine gun sounds)

Erin Welsh: (laughs) Angels with Filthy Souls, yes. And then there's the word 'plumb' itself which means upright or level and that comes from the fact that historically people would use lead tools like a plumb bob to get a true vertical line.

Erin Allmann Updyke: Whoa, I didn't know that.

Erin Welsh: Yeah, it's so cool. Okay but this isn't the history of lead, this is the history of lead poisoning. And it turns out that that reaches back almost as far as the use of lead itself which is unsurprising.

Erin Allmann Updyke: Yes.

Erin Welsh: Descriptions of lead poisoning date back basically to, I don't know, around 6000 years ago.

Erin Allmann Updyke: Okay. Long time.

Erin Welsh: Yeah, really long time. And these descriptions didn't necessarily identify lead as the source of the symptoms, it was more just describing somebody who had clearly a case of acute lead poisoning. But some actually did make the connection between lead exposure and lead poisoning. Like scrolls from Ancient Egypt for example discussed the role of lead in intentional poisoning because people would sometimes use lead acetate to intentionally poison people. And lead poisoning in minors in Ancient Rome also allowed people to make this connection between exposure and illness. The history of lead poisoning can basically be divided into occupational exposure and then nonoccupational exposure. So since lead was used in so many ways like making glass or coins or kitchenware or statues or pigments or food additives or plumbing or roofs or gutters or shipbuilding-

Erin Allmann Updyke: (laughs) Like literally of the things that humans have ever done or used ever.

Erin Welsh: Everything, everything. Then if you were involved in any of these trades, there were tons of ways to get exposed. But the biggest exposure probably happened for miners who would experience acute lead poisoning, so this is where the concept of miasma also probably gains some support cause people who spent-

Erin Allmann Updyke: Oh!

Erin Welsh: Yeah.

Erin Allmann Updyke: I never even thought about that.

Erin Welsh: Cause these people who spent a lot of time in or near mines which were also located in geographically or geologically very specific areas probably got sick.

Erin Allmann Updyke: Oh my gracious.

Erin Welsh

Isn't that cool?

Erin Allmann Updyke

Yeah. I mean not cool for them but very interesting.

Erin Welsh

It's very interesting. And there was so much lead mined historically and there still is today, I mean it has only gone up over time basically, that current estimates though of the number of workers who were exposed to lead during the Roman Empire was around 140,000 people per year.

Erin Allmann Updyke

What?

Erin Welsh

Yeah. Lots of lead exposure. That was just in lead miners. So even if you weren't a lead miner though, there were plenty of ways that you could encounter enough lead to experience acute or chronic lead poisoning and Ancient Rome was not the only place that you had a high chance of getting that. In China for example, cookware had a super high content of lead, so some ancient bronze vessels contained over 30% lead. So if you cooked anything in those it's just gonna leach out into your food.

Erin Allmann Updyke

Calling it bronze and it's mostly lead.

Erin Welsh

Yeah. (laughs) And drinking vessels were also made of lead or lead alloys. Lead tumblers have been found in graves dating back to 3000 BCE and let's throw in Ancient Egypt into the mix as well. But Ancient Rome is infamous for their use of lead in all facets of life. So if your veggies weren't sweet enough, no problem! Just cook it in a lead pot or add lead acetate. You could become exposed by handling lead coins or yarns, many of which were treated with lead salts, children's toys were made of lead, candleholders and wickholders made of lead or pewter could be partially evaporated while burning the candle, and then there's-

Erin Allmann Updyke

I'm sorry.

Erin Welsh

Go ahead.

Erin Allmann Updyke

Real quickly, does lead make your vegetables taste sweeter?

Erin Welsh

Yes!

Erin Allmann Updyke

I'm still stuck on that.

Erin Welsh

So lead acetate was a common or something called Roman sapa I think, something like that, it was basically like you added... For some reason adding lead acetate made things sweeter, like it imparted a sweet taste.

Erin Allmann Updyke

Oh that is horrible.

Erin Welsh

Oh yeah. Well just wait, I mean...

Erin Allmann Updyke

Here it comes.

Erin Welsh: Okay. And then there lead paint of course, lead in cosmetics or hair dye. And then there's the medicinal uses of lead. So lead was prescribed to remove scars, to curb nocturnal emissions, I don't know how exactly-

Erin Allmann Updyke: I have some guesses but I don't think they're right.

Erin Welsh: (laughs) This one is horrific, to heal the bellybutton of a newborn after the umbilical cord has fallen off.

Erin Allmann Updyke: Oh no, you don't need to heal that!

Erin Welsh: Nope.

Erin Allmann Updyke: The goo is supposed to be there.

Erin Welsh: To help scorpion stings, for preserving your singing voice, in contraception - so get this, you were supposed to smear a honey and cedar and lead mixture on your cervix before having sex.

Erin Allmann Updyke: What? Okay so many issues with that, oh my goodness.

Erin Welsh: I know. (laughs) Even just honey and cedar alone. Don't smear anything on your cervix.

Erin Allmann Updyke: Yeah. Don't smear anything on your cervix please.

Erin Welsh: My goodness. Lead was also used to soften tumors, as eye medicine, and to heal anal fissures.

Erin Allmann Updyke: Oh no, Erin!

Erin Welsh: I feel like these are 100% all problematic.

Erin Allmann Updyke: Yes.

Erin Welsh: And so for these things, for some of these medicinal uses, lead lotion was great while sheets of lead were used for others. So our quarantini is a sangria, the base is red wine. Lead was used in winemaking for centuries and centuries. So it could be used to stop fermentation or to add color or sweetness. That's why we decided to have a sangria for this one. And then there's the lead pipes of Ancient Rome. So in Ancient Rome water pipes were made of lead and this led to an interesting health disparity, kind of the opposite of the one that we see today. So those who are wealthier often had more access and exposure to lead like having lead water pipes, so we see some of the most prominent cases of lead poisoning in richer populations and among the aristocracy.

Erin Allmann Updyke: Interesting.

Erin Welsh: Later investigation, archeological and anthropological investigation of sort of Ancient Roman water pipes shows that the water was constantly, it wasn't sitting in pipes ever the way that it does now. And so there probably wasn't a lot of lead leaching into that water.

Erin Allmann Updyke: Okay.

Erin Welsh: In addition to the fact that it was probably coated on the inside with other scaly metals and so the water itself was more or less protected from the lead in the pipes.

Erin Allmann Updyke: Okay, interesting.

Erin Welsh: Anyway. So there's been a lot of retrospective diagnosis, so take this with a grain of salt, of many of the Roman emperors from 50 BCE to 250 CE that suggests that they were basically all suffering from too much lead.

Erin Allmann Updyke: I mean, yeah.

Erin Welsh: Yeah. And so I can't go this entire episode without talking about the fall of the Roman Empire which is why we named our quarantini this.

Erin Allmann Updyke: Cannot.

Erin Welsh: So a few decades ago a guy named Jerome Nriagu published his hypothesis that the decline of the Roman Empire was caused by widespread lead poisoning, especially among the wine drinking and lead water consuming aristocracy and that the decreasing fertility and higher rates of psychosis that followed really caused this massive intellectual and structural decline.

Erin Allmann Updyke: Wow.

Erin Welsh: This is kind of an older hypothesis but when he published this paper it gained a lot of attention and there's been a ton of response papers either in support or more often refuting this hypothesis. Studies examining the amount of lead in ancient roman bones show similar lead levels as in modern populations or modern populations have higher lead.

Erin Allmann Updyke: Oh, interesting.

Erin Welsh: And in general this hypothesis doesn't really have a lot of widespread support anymore.

Erin Allmann Updyke: Okay.

Erin Welsh: So lead poisoning may have contributed but it probably wasn't the main cause.

Erin Allmann Updyke: Multifactorial, let's say.

Erin Welsh: Yeah. But despite this we decided to perpetuate the false notion by naming our quarantini The Fall of Rome.

Erin Allmann Updyke: It's a good name, still.

Erin Welsh: I know, I like it. So we know that people were likely experiencing acute or chronic blood poisoning based on how much lead they used but when did they start making the connection between exposure and illness?

Erin Allmann Updyke: Yeah.

Erin Welsh

And that would've been really difficult to do because lead poisoning can manifest in so many different ways, especially with chronic low level lead poisoning.

Erin Allmann Updyke

Yeah.

Erin Welsh

There do seem to be reports of epidemic or pandemic lead poisoning which were often called pandemic attacks of colic, the first of which was sometime during the 7th century CE. And these pandemics continued until around the 16th century when a German physician figured out it was linked to wine that was supplemented by lead. And so from that point onwards a lot of countries were like no, you cannot use lead in wine making anymore. And so that probably in some ways lowered chronic lead exposure but obviously it was still around.

Erin Allmann Updyke

Right.

Erin Welsh

It was just like one tiny little area of life.

Erin Allmann Updyke

Right.

Erin Welsh

So in cosmetics for example people used to use it as like a paste to hide smallpox scars and just to make themselves prettier.

Erin Allmann Updyke

Oh gosh.

Erin Welsh

But the problem with topical lead application is that it poisons you.

Erin Allmann Updyke

Yes it does.

Erin Welsh

So many people who wore this lead-based concealer would end up with ruined skin and hair loss and this led to a fad in Elizabethan times of shaving the front of your hairline.

Erin Allmann Updyke

Are you serious?

Erin Welsh

I'm serious.

Erin Allmann Updyke

That's because of lead?

Erin Welsh

Yeah!

Erin Allmann Updyke

You've seen all the pictures of them with like no hair. Oh my gracious.

Erin Welsh

Yeah, according to this book I read, yeah.

Erin Allmann Updyke

Wow.

Erin Welsh

Okay. And so even though the dangers of lead were known, cases of acute lead poisoning continued to occur. Apparently lead poisoning from rum could be quite an issue depending on where the rum was aged and the industrial revolution basically ensured that everyone, everyone, whether you worked with lead or not, would be exposed to lead. And this period marks a kind of shift in the history of lead poisoning. So up to this point acute lead poisoning was definitely recognized but low levels of lead poisoning weren't really thought to be harmful even though they very much are. In the late 1800s and into the 1900s, the focus on at-risk populations for lead poisoning shifted from people who worked with lead to children who as you mentioned for all of those reasons are high risk.

Erin Allmann Updyke

Yeah.

Erin Welsh

Chronic lead poisoning in children was first recognized in the late 1800s in Australia but it was met with complete disbelief.

Erin Allmann Updyke

Yeah.

Erin Welsh

Lead had been around, people had been using it for ages.

Erin Allmann Updyke

It can't be bad.

Erin Welsh

Yeah. It would take until the 1920s for lead-based paint to be banned in Australia and in much of Europe and another 50-60 years after that for it to be banned in the U.S.

Erin Allmann Updyke

Wow.

Erin Welsh

So doing great.

Erin Allmann Updyke

Doing great.

Erin Welsh

Okay for the last bit of this history section I wanted to focus on childhood lead poisoning in the U.S. because it's really well documented sort of the history and the politics surrounding it and I think it's such a perfect example of how politics and public health are intertwined.

Erin Allmann Updyke

Oh Erin, this is gonna be a political episode. Cause just wait til the epidemiology.

Erin Welsh

Oh, here we go. Okay so first I wanna set the stage a little bit because the presence and persistence of lead poisoning throughout today is just part of a long held trend in ignoring the systemic problems in pollution, poor housing, water infrastructure, etc that cause huge health disparities.

Erin Allmann Updyke

Mm-hmm.

Erin Welsh

Over the past let's say 200 years there have been huge improvements in the overall health of the world due in part to the advancements in knowledge about how infectious diseases are transmitted and how chronic diseases can be caused or worsened by some environmental contaminants. But it was really public health efforts focusing on groups of individuals or improving infrastructure that led to those improvements rather than physicians treating the individual. So things like vaccine campaigns and improved housing and workers rights and clean food and water legislation.

Erin Allmann Updyke

Yeah.

Erin Welsh

These things treated the underlying cause of many illnesses rather than the illness itself.

Erin Allmann Updyke

Yeah.

Erin Welsh

And prevention saves much more than treatment after the fact.

Erin Allmann Updyke

An ounce, a pound, etc.

Erin Welsh

Yeah, exactly. And for a long time from the late 1800s to the mid 1900s, around there maybe, these systemic improvements really did help improve overall health. But at some point that focus sort of switched from treating groups of people or treating the underlying issues to treating the individual who was diseased and reducing overall exposure but not prevention in terms of like there was not a lot of push for improving housing quality or water purity. And those were the things that disproportionately affected people living at or below the poverty line.

Erin Allmann Updyke

Yeah.

Erin Welsh

Okay, lead. So even though it was known that lead was bad, the use of lead actually increased in the 20th century. It was added to gasoline to give the cars more power, it was in paint to help the walls shine. Throughout the mid 20th century the U.S. interstate highway system greatly expanded which allowed for the deposition of lead in soils basically all over the country. And it's not like people hadn't thought of the potential danger of this leaded gasoline. As early as the 1920s people had expressed their concern but the Lead Industries Association funded scientific research specifically to come to the conclusion that lead was a natural part of the human environment and since humans had been working with lead for thousands of years, it was safe.

Erin Allmann Updyke

People have been working with lead for thousands of years, people have been dying from lead for thousands of years.

Erin Welsh

Yeah.

Erin Allmann Updyke

Oh my gosh. The 1920s.

Erin Welsh

Yeah I mean as early as the 1920s the dangers were known but there was already pushback from the Lead Industries Association, yeah.

Erin Allmann Updyke

Right. Oh my gracious.

Erin Welsh

And so this was their line, this was their stance for the next four decades basically, actually beyond that until it was overturned by the overwhelming evidence that any lead exposure at all was harmful.

Erin Allmann Updyke

Yeah.

Erin Welsh

But by then so much damage had been done and it's still being done. So around the 1940s physicians and researchers in the U.S. started to become aware that lead poisoning, both chronic and acute, could lead to long term damage. So that children who presented with signs of acute lead poisoning and then recovered would probably never recover completely but would always carry effects like developmental delays, behavioral problems, learning disabilities and so on. City-wide epidemics of lead poisoning in children in the 1950s were seen in places like Chicago, Baltimore, New York City, Cincinnati, and St. Louis and these brought greater attention to the issue that lead-based paint caused. But the Lead Industries Association fought against these negative portrayals of lead. They embarked on or continued their propaganda machine about how much better lead was than any other material for pipes and paint and gasoline. They downplayed or outright denied the reports of widespread lead poisoning, often making fun of the victims or putting the responsibility on the parents and the child how had lead poisoning, saying well they should have been watching the kid more.

Erin Allmann Updyke

Oh my gracious.

Erin Welsh

They took the line that if it didn't affect the health of the average person then it wasn't worth changing.

Erin Allmann Updyke

And their definition of the average person-

Erin Welsh

Is going to be a wealthy person who's above the poverty line.

Erin Allmann Updyke

White person.

Erin Welsh

White person, exactly. And so this resistance to do anything about lead obviously slowed down the social reform that was needed to actually help fix the issue of lead everywhere. In 1967 a physician named Jane Lin-Fu published a widely circulated booklet that discussed the issue of lead, particular lead-based paint, and it did largely ignore the effects of gasoline and other exposures which weren't as recognized, that was sort of the standard at the time. But she framed this lead poisoning, this chronic lead exposure as a public health issue which some public health officials took exception to, saying that no, this is a housing issue not a matter of public health. And this was this unnecessary divide that would slow down progress for a really long time.

Erin Allmann Updyke

Oh my god. That's infuriating.

Erin Welsh

Well it's a difference of labeling and it's a difference of 'we don't wanna be responsible for this, this isn't on us'.

Erin Allmann Updyke

Right.

Erin Welsh

Yeah.

Erin Allmann Updyke

Yeah.

Erin Welsh

And so even though people clearly recognized that low levels of lead posed a health problem by the 1970s, the magnitude of the problem wasn't as well known. Erin, so you know the NHANES survey?

Erin Allmann Updyke

Yes I do!

Erin Welsh	Okay. So NHANES stands for National Health and Nutrition Examination Survey and basically its purpose is to document the health of the American people. So they measure all kinds of things, it's been amazing in terms of monitoring exposures, health status, whatever. In 1976 blood lead levels were included in the survey for the first time and they revealed that 1 out of every 25 kids between the age of 6 months and 5 years had blood lead levels greater than 30 mcg per deciliter.
Erin Allmann Updyke	Whoa!
Erin Welsh	Yeah. Based on the U.S. population at that time, that calculates to around 780,000 children under 6 years old that had lead poisoning.
Erin Allmann Updyke	30! At 30! And that's really high.
Erin Welsh	That's very high. And then there were enormous racial, locational, economic differences in terms of the rate of lead poisoning as well. So while only 2% of white children had elevated blood lead levels, 12.2% of black children had elevated blood lead levels. And urban children fared worse than rural children, 11.6% to 2.1%. In families whose combined income was \$15,000 or more, which was like around \$35,000-\$40,000 in nowadays money-
Erin Allmann Updyke	Okay.
Erin Welsh	1.2% of children were affected while in families with a combined income of less than \$15,000 in 1976, so less than \$35,000-\$40,000, in those families 10.9% of children had elevated blood lead levels, lead poisoning basically.
Erin Allmann Updyke	Yeah.
Erin Welsh	So okay. The early 1970s also saw the emergence of another big lead researcher, Herbert Needleman, whose pioneering work on low lead level exposure would revolutionize our understanding of the risk.
Erin Allmann Updyke	All right.
Erin Welsh	In one study he compared the lead level in baby teeth from children in suburban homes and in poor communities and he found that those in the poor, urban communities had almost five times the amount of lead compared to the ones in the suburbs.
Erin Allmann Updyke	I also will say it's so genius to start using baby teeth as the level because like I said earlier, the levels in your blood can change much more rapidly than the levels in your teeth and often you're testing kids that are older when the exposure happened when they were a lot younger.
Erin Welsh	Yeah.
Erin Allmann Updyke	So it was very genius to use baby teeth.
Erin Welsh	Yeah this research was groundbreaking because it also showed that even at low levels of lead exposure, levels that were considered safe by the CDC there were still observable long term effects of lead exposure.
Erin Allmann Updyke	Yeah.

Erin Welsh: Obviously the lead industry did not like this.

Erin Allmann Updyke: Oh, shocking.

Erin Welsh: And they brought on, basically just pain money to a prominent lead researcher whose primary purpose it seems was to discredit Needleman's studies and any other study showing that low level lead exposure was dangerous. This seed of doubt actually had an influence on government decisions and regulations by the EPA which is hugely worrying but also not surprising especially considering climate change and stuff today. So this is a great example of how politics and public health become enmeshed especially when the government gives equal forum to both the industry whose livelihood depends on the outcome of these studies, so this enormous conflict of interest, and the scientists who are reporting their findings as objectively as humanly possible.

Erin Allmann Updyke: Oh gracious.

Erin Welsh: Even when a conflict of interest is clearly declared it can still be hugely damaging once that seed of doubt is planted. All right os because lead poisoning was labeled as a housing problem, back to this issue, it became inherently politicized especially in the 1980s and into the 1990s where proposed lead elimination or prevention policies were labeled as leftists politics and social engineering. By this time the scientific consensus was clear, there was no safe level for lead exposure. Leaded gasoline was no longer used and lead-based paint had been banned as of 1978 but the risks of exposure were far from over, it wasn't like oh we banned these so now no one's gonna get exposed.

Erin Allmann Updyke: Yeah.

Erin Welsh: Soil was chock-full of lead around highways and lead-based paint is still, you have to sing waivers anytime you move into a house that was built before 1978.

Erin Allmann Updyke: My house was built in 1929, so geez.

Erin Welsh: Yeah.

Erin Allmann Updyke: Yeah.

Erin Welsh: Millions and millions of houses or buildings had lead-based paint and abatement was extremely expensive and carried its own risks. So the dust created during the abatement process and even during everyday living by opening a window with lead-based paint trim could reach poisoning levels. Conservative estimates for the complete removal of lead-based paint from the 64 million federally-owned housing units was around \$10,000 per unit in 1990 dollars.

Erin Allmann Updyke: Ooh, wow.

Erin Welsh: So many landlords and the government also basically was like we're either gonna abandon ship or we'll just ignore the problem completely.

Erin Allmann Updyke: It's a lot easier than fixing it.

Erin Welsh: Yeah, it's a lot easier than fixing it and it's a lot cheaper because let's say you're a landlord and you were required to do lead-based paint abatement and you didn't do it, you could be taken to court which could take months or years and then you're like oh, here's a \$400 fine. Like that's basically it.

Erin Allmann Updyke: I'm sorry, \$400 fine?

Erin Welsh: I don't know if that's exactly what it was but it wasn't \$10,000.

Erin Allmann Updyke: Right, ugh.

Erin Welsh: And so seeing this huge task in front of them, the public health approach switched from risk prevention to risk reduction. How can we most cheaply do lead-based paint abatement was the bottom line. And it's sort of putting a price tag on the health of the American children. It's outrageous. Okay. And in walks the Kennedy Krieger Institute study on lead-based paint. Have you heard of this?

Erin Allmann Updyke: No, I haven't.

Erin Welsh: Okay. In 1991 this institute began the study that would eventually be compared to the Tuskegee syphilis experiment that I talked about in our syphilis episode where poor black men were preyed upon by researchers to study the effects of untreated syphilis. This lead-based paint study which began in 1991-

Erin Allmann Updyke: Oh no.

Erin Welsh: 1991-

Erin Allmann Updyke: Oh no!

Erin Welsh: Involved 108 families of single mothers with young children. The researchers placed these families in houses with varying levels of lead, from no lead to lead levels just within Baltimore's legal limit.

Erin Allmann Updyke: I'm sorry they put people in houses with lead?

Erin Welsh: With lead, yes.

Erin Allmann Updyke: In 1991.

Erin Welsh: Yes.

Erin Allmann Updyke: Single moms. Okay.

Erin Welsh: Single moms.

Erin Allmann Updyke: Great.

Erin Welsh: And then they would try out different kinds of lead-based paint abatement which periodically monitoring the blood lead levels in the families. Their goal was to find the most cost effective way to reduce lead-based paint, so how cheaply could you achieve lower lead levels in the blood using children as biological monitors.

Erin Allmann Updyke: Oh my god, oh my god, oh my god.

Erin Welsh: I know. The researchers of course acknowledged that no lead-based paint would be the best level but they argued that most landlord would abandon the houses if required to shell out a bunch of money on lead-based paint abatement and so then these people would continue to live at dangerous levels. So their argument was well we're taking them out of houses with potentially worse lead conditions and hoping to use this knowledge to help everyone, everywhere.

Erin Allmann Updyke: Just some tiny children guinea pigs, no big deal.

Erin Welsh: Yeah, it's appalling. So this was human experimentation and despite their intentions, the researchers knowingly placed children in homes where they knew they could be exposed to potentially dangerous levels of lead.

Erin Allmann Updyke: Because any lead exposure is dangerous.

Erin Welsh: Yep. And this was well known by the 1990s.

Erin Allmann Updyke: Of course it was! Erin, I'm raging.

Erin Welsh: I know, I know. Me too. So when the study came to light in the late 1990s, the researchers were taken to court and the court found that they had engaged in unethical research that defied many aspects of the Nuremberg Code and bore similarities to Nazi experimentation which is strong language.

Erin Allmann Updyke: Yeah.

Erin Welsh: But it is still appalling and unethical.

Erin Allmann Updyke: What IRB approved this quite honestly?

Erin Welsh: But they did get IRB approval.

Erin Allmann Updyke: Of course they did, it was the 90s.

Erin Welsh: It's very concerning.

Erin Allmann Updyke: It's very concerning.

Erin Welsh: Yeah.

Erin Allmann Updyke: Wow.

Erin Welsh

And the two people who led the study were renowned lead researchers and children's health advocates. So yeah, there's much more discussion about this experiment itself and the court battle and so on in the book 'Lead Wars' so I encourage people to look into it.

Erin Allmann Updyke

Okay.

Erin Welsh

But still the bottom line is that in this experiment and as it continues today, children are being used as canaries in the mine or these biological monitors for lead content. And a society is measured by its treatment of its children. So the firsthand account features a boy who experienced acute lead poisoning which was treated by the doctors and nurses that he saw but they could only help treat him, not the underlying problem. The hospital had no ability to intervene with the landlord's failure to repair the home. This is something that still happens today. And in the words of the authors of 'Lead Wars', John, who was the kid from the firsthand account, was suffering from more than an environmental exposure to a known neurotoxin caused by shoddy landlords and peeling paint. He suffered from a social and economic system that condemned his family to poverty and racial discrimination as well as the urban decay that put him in harm's way.

What John experienced was acute lead poisoning which fortunately has been largely controlled in the U.S. over the past century. But chronic lead poisoning caused by long term exposure to low levels of lead is still a huge problem. Look at the Flint, Michigan water crisis for example. Look at many cases of this all over the U.S., all over the world. There have been so many large scale lead poisoning epidemics often associated with lead smelters. There was one for instance in Nigeria in 2010 that has caused the deaths - the deaths - of at least 400 children. It's still ongoing, this issue.

Erin Allmann Updyke

Oh my god.

Erin Welsh

Yeah.

Erin Allmann Updyke

Ugh, it's so infuriating because it's so preventable.

Erin Welsh

Yeah. And the problem of lead exposure can't be solved with just a medical intervention. If there's going to be any lasting change there has to be reform at a systemic level. The issue of lead exposure and other environmental or occupational hazards is a perfect example of how politics and public health have to go hand in hand. The people who are in power and can make these changes, our elected officials, they're not the ones at risk for lead poisoning.

Erin Allmann Updyke

Nah, dude.

Erin Welsh

And they'll never be because they can afford not to be. And then to get any movement on that front, public health officials might push for more easily digested regulations like redefining what an acceptable level of exposure is. But that undermines the credibility of public health. When presented with the suggestion that complete abatement of lead-based paint was the only way to end the issue of lead poisoning, many elected officials dismiss it out of hand as a utopian dream. This viewpoint just perpetuates the cycle of poverty. Erin, on that note, tell me where we stand with lead poisoning today.

Erin Allmann Updyke

Oh let's talk about it Erin. Ooh, I need a quick break after that.

Erin Welsh

Yep.

TPWKY

(transition theme)

Erin Allmann Updyke

Okay. First off did you know that elevated blood lead levels were the first noninfectious notifiable condition in the U.S.?

Erin Welsh

No, I didn't know that. When?

Erin Allmann Updyke

Me neither. 1995 or '96.

Erin Welsh

Oh my god, that sounds really late.

Erin Allmann Updyke

It is very recent. Even my youngest brother was born by then, so yeah.

Erin Welsh

Wow.

Erin Allmann Updyke

So yeah, anyways. It used to be that elevated blood levels of lead were only considered when you had a blood level over 60 since that's when the clinical symptoms are most commonly seen.

Erin Welsh

Right.

Erin Allmann Updyke

But at some point, I think it was in the 1970s, that level was decreased to 10 and that was considered the safe limit. But since 2012 the way that it works is there is no safe limit. I mean we knew this from before but since 2012 there is no longer anything considered a safe limit or even a level of concern.

Erin Welsh

Right.

Erin Allmann Updyke

So now what they use, the CDC uses a blood lead reference value. So what that means is that they look at the blood using the NHANES data that you talked about, they estimate the average blood lead level among children in the U.S. and the highest 2.5% of children, that cut off value is what they use to consider 'elevated'. Does that make sense?

Erin Welsh

Yes.

Erin Allmann Updyke

So right now in 2019 that level is 5. 5 mcg per deciliter is considered quote "elevated". That's what the elevated lead level is considered now. The CDC's push is every four years they reevaluate that and they want to get it down to as low as humanly possible, right, that's the goal.

Erin Welsh

Yeah.

Erin Allmann Updyke

So that no child is exposed to any level of lead, that's the goal. Worldwide, according to the WHO which cited the Institute for Health Metrics and Evaluation, I hadn't heard of that institute before but they estimated that in 2017 lead exposure across the globe accounted for 1 million deaths in 2017 and 24.4 million years of healthy life lost.

Erin Welsh

I just got chills.

Erin Allmann Updyke

Yeah.

Erin Welsh: That is such an incredible loss of life and life years. Wow.

Erin Allmann Updyke: Yeah. The highest burden unsurprisingly is in low and middle income countries. They estimated that in 2016 lead exposure accounted for 63% of the total burden of intellectual disability across the globe.

Erin Welsh: Oh my gosh.

Erin Allmann Updyke: 10% of hypertensive heart disease which nobody thinks about being associated with lead but like we talked about the effects of lead on your kidneys can have major effects on your blood pressure and blood pressure just destroys your heart, having high blood pressure.

Erin Welsh: Yeah.

Erin Allmann Updyke: And then also 5% of the global burden of ischemic heart disease, so that's when you have clots in your blood that means your heart isn't getting enough blood. And 6% of the global burden of strokes as well.

Erin Welsh: Wow!

Erin Allmann Updyke: All this from lead exposure.

Erin Welsh: From lead.

Erin Allmann Updyke: Yeah. That's worldwide.

Erin Welsh: And this is something that is not getting any better.

Erin Allmann Updyke: Not fast enough, that's for sure.

Erin Welsh: Yeah.

Erin Allmann Updyke: Yeah.

Erin Welsh: It's going to take decades because like you said, I'm still stuck on the whole leaching out of your bones over time like a slow drip of poison.

Erin Allmann Updyke: Oh my gosh, right? Yeah, it's terrifying. So in the U.S. of course it was Flint, Michigan that brought lead poisoning back to the front page news. We can't have an episode about lead poisoning and not talk about the situation in Flint, Michigan.

Erin Welsh: Yeah.

Erin Allmann Updyke: In 2014, if you don't know the story of Flint maybe you don't live in the U.S. because I feel like I don't know how you could live here and not have heard about this, right?

Erin Welsh: Yeah.

Erin Allmann Updyke In 2014 the city of Flint decided to switch from using Lake Huron and the Detroit River as their water source to the Flint River because it was going to be a lot cheaper. However the water in the Flint River was more corrosive and they did not take that into consideration whatsoever and most of the pipes in Flint were lead pipes. The pipes that led into people's houses, water pipes made of lead.

Erin Welsh Mm-hmm.

Erin Allmann Updyke So first of all I mean this was such a disaster, it's too big of a topic to even talk about in a lot of detail because the situation in Flint was managed horribly, it was so severe, tens of thousands of homes were affected, and it took literally years for people to gain access to safe water again.

Erin Welsh Even though many people now have access to safe water the effects of that lead exposure is still lingering in a huge way.

Erin Allmann Updyke Exactly, exactly. Like children in Flint are going to be affected for the rest of their lives because of this. It was and remains a terrible, horrible situation. But here's the thing: it's not just Flint.

Erin Welsh Oh no.

Erin Allmann Updyke A study in 2017 estimated that 1.2 million cases of blood lead levels over 10 mcg per deciliter which is twice what's considered elevated today-

Erin Welsh Right, if you shifted that to 5, what would that...

Erin Allmann Updyke Right. 1.2 million cases occurred in children between the years 1999-2010.

Erin Welsh Wow.

Erin Allmann Updyke However only 600,000 of those were reported. So that means that half potentially of children who have elevated blood levels of lead, no one is reporting that which means we don't know which means they're not getting treatment.

Erin Welsh Yeah, yeah.

Erin Allmann Updyke Or having their exposures reduced because we don't know about their exposures.

Erin Welsh Oh my gosh.

Erin Allmann Updyke And like you said, that's at an elevated blood level of 10 mcg. 5 is considered elevated so who knows what that numbers is if you consider it to be 5 mcg.

Erin Welsh Yeah.

Erin Allmann Updyke The problem, there's many problems that we'll see. But a large part of it is that most children are never tested for their blood lead levels. It's not required by the federal government or by state governments. It is only required to test children who are Medicaid beneficiaries but in reality less than half of those children are even actually tested. So those are the children that we know are likely the most vulnerable and only half of them are being tested and the rest of the children in the U.S. not even tested.

Erin Welsh: Wow.

Erin Allmann Updyke: So people sometimes tell us to stop being so political and stick to science on this podcast.

Erin Welsh: There's no such thing.

Erin Allmann Updyke: There is absolutely no such thing. There are at least two big risk factors that we know that massively increase the risk of lead exposure in children. The age of the house in which they live, right, because that's lead paint exposure, and poverty because poverty is the biggest risk factor.

Erin Welsh: Yes. Right.

Erin Allmann Updyke: There are some really great maps, VICE and Vox, both the news outlets, VICE and Vox, made maps. So the Vox map especially is every census tracked in the entire country. It was Vox plus the Washington Department of Health, they estimated the risk of lead exposure based on those two risk factors, the age of houses and the level of poverty in the area, to estimate the level of lead exposure risk across the whole country. Okay?

Erin Welsh: Mm-hmm.

Erin Allmann Updyke: We'll put a link to those maps on our website, they're really interesting, you should check them out. Here's the thing about when you look at those maps. Erin, we're gonna role reverse and I'm gonna tell you some history.

Erin Welsh: Oh great.

Erin Allmann Updyke: In the 1930s after the Great Depression the Homeowners Loan Corporation was requested to make maps of cities to assess the riskiness of mortgagees for lenders to try and get lenders back to lending to people to buy homes to fix the Great Depression or whatever. Okay?

Erin Welsh: Mm-hmm.

Erin Allmann Updyke: These maps are outrageously racist.

Erin Welsh: Of course.

Erin Allmann Updyke: So what they did was outline in red, hence the term 'redlining', the most undesirable or hazardous neighborhoods from a mortgage lending perspective. Guess what neighborhoods were red-lined? Neighborhoods where black people lived, period.

Erin Welsh: Yeah.

Erin Allmann Updyke: And the descriptions of why certain neighborhoods were red-lined, like you can read these descriptions, they were labeled as high risk if a single black person lived in that neighborhood, that was it.

Erin Welsh: Oh my god.

Erin Allmann Updyke

So guess who didn't get home loans? People who lived in those neighborhoods, aka black people, okay. So this led to continued impoverishment of those areas that persists today. If you look at maps today of areas that are still where the median household income is lower than what is average for the country, it's still those red-lined areas.

Erin Welsh

Wow.

Erin Allmann Updyke

Now if you overlay the maps of current lead exposure risk and the redline maps from the 1930s, they match up.

Erin Welsh

Of course they do.

Erin Allmann Updyke

The areas where people are still being exposed to major health risks are directly because of systemic outright racism in this country.

Erin Welsh

And this is why there's no separation of public health and politics between science and politics. It's inherent to this and I mean I wish that it weren't, I wish that it would be here's this problem, we have the money to fix it, let's fix it.

Erin Allmann Updyke

Right?

Erin Welsh

But it's not that because there are the interests of the industries at play, there's these political parties who are backed by the industries, it's everything is so interwoven that it's impossible to talk about it in a vacuum.

Erin Allmann Updyke

Yep.

Erin Welsh

And it's not effective to talk about it in a vacuum.

Erin Allmann Updyke

No, it's useless.

Erin Welsh

There's no context, you have to have the context, the historical, the political, the social context to understand why disease happens where it happens.

Erin Allmann Updyke

Yep, exactly. So that's the state of lead poisoning in the world and especially in the U.S. today. While we have seen major reductions overall in the blood lead levels of children in the U.S. the health disparities cannot be ignored. People who live at less than 130% of the federal poverty level are more than twice as likely to have elevated blood levels. Black children are more than twice as likely to have elevated blood levels than white children. It's very bad. It's not a problem that is isolated to just one city, it is not a problem that is isolated to just a few areas, it's rampant across the country no matter where you live.

Erin Welsh

Yeah, it is.

Erin Allmann Updyke

So that is lead poisoning, Erin.

Erin Welsh

Wow. Yeah it is.

Erin Allmann Updyke

Well then.

Erin Welsh: So yeah, this was a very heavy episode, heavy metal episode.

Erin Allmann Updyke: Ha! Sorry that was funny.

Erin Welsh: But it is, I mean it's a hugely important topic.

Erin Allmann Updyke: Yeah I think a lot of people think that lead poisoning... Like Flint, Michigan made the news because it was so egregious, the water that was coming out of people's taps was clearly contaminated and people were being exposed to levels of lead dozens of times the...there is no safe level but extremely high levels of lead, right.

Erin Welsh: Yeah.

Erin Allmann Updyke: And so that's I think why is made such news because it was massive and thousands of children and adults, they haven't even tested the levels of blood in adults in Flint which is atrocious.

Erin Welsh: Right.

Erin Allmann Updyke: Hundreds of thousands of people are likely affected from this and that deservedly made the news. But children are being affected by this everyday and people don't even realize that it's still a thing outside of these headline-grabbing situations.

Erin Welsh: It's a huge thing and it's not going to go away anytime soon.

Erin Allmann Updyke: Right.

Erin Welsh: But it's such a problem because the people who are the most affected by it don't have a voice to do anything about it and that's just part of the disenfranchisement of entire groups of people because they live at or below the poverty line, systemic racism, all of these things.

Erin Allmann Updyke: Exactly, yep. Yeah.

Erin Welsh: Yeah.

Erin Allmann Updyke: But you know let's not get political, Erin. Let's stick to our lane. Do you have any sources?

Erin Welsh: Yeah, we're scientists, not politicians so we should only talk about science. Okay, sources. I read a couple of books, one is called 'Lead and Lead Poisoning in Antiquity' so that's where I got a lot of the Ancient Roman stuff. And then 'Lead Wars: The politics of science and the fate of America's children' by Gerald Markowitz and David Rosner. This book was great, I highly recommend it. And then I also read some papers that I'll post, a few by Needleman of course. And we'll post all of these on the website.

Erin Allmann Updyke: Yeah, if you would like links to the Vox map that was made by both Vox and the Washington Department of Health, we will post that link as well as if you're interested in those redline maps, the University of Richmond has online interactive all of the maps that were made during that redlining time where you can see exactly what areas were redlined and the descriptions on why they were redlined.

Erin Welsh: I need to read this, I need to see this.

Erin Allmann Updyke

Yeah, it's very horrifying. So as always we'll post the links to all of our sources on our website thispodcastwillkillyou.com, just click on EPISODES and you can see the sources from this episode and all of our episodes.

Erin Welsh

Thank you to Bloodmobile for providing the music for this episode and all of our episodes.

Erin Allmann Updyke

And thank you dear listeners for listening to this podcast, allowing us to make it, and getting righteously angry right along with us.

Erin Welsh

Heck yeah. Well with that, wash your hands.

Erin Allmann Updyke

You filthy animals.