TPWKY – Ep 188 – Candida

Candida Firsthand: Let me take you back to when I was a weird, nerdy 14-year-old. I'd recently started menstruating and was incredibly self-conscious about managing my periods at school. The popular girls would congregate in the school bathroom, so they'd hear the unzipping of my bag and the crinkle as I unwrapped sanitary products from their packaging. I was terrified about what gossip would be spread around school if people found out that I was on my period. I made the decision to avoid changing my sanitary products at school. This created a lovely, warm, moist environment for yeast, so it's no surprise that I got a yeast infection, or thrush.

Candida Firsthand: If you have not had the pleasure, it's like an infected horsefly bite. It's an incessant itch that is constantly screaming for attention. I couldn't sleep. It hurt to pee. I couldn't concentrate on anything except for the pain of the itch. This coupled with being a teenager with hormones coursing through my body, the shame and self-loathing of my poor decision made this a really distressing time. To add to my humiliation, I had to tell my GP about my symptoms, but I lacked the polite vernacular to do so. I eventually stammered that I had an itch at the front of my bum, and the GP took pity on me and my mum was able to take over the consultation. I was asked no further questions and no invasive tests were performed. I was given a prescription for Canesten, and this was the first time I had ever used a pessary and had no idea whether I was inserting it correctly. However, I recovered and became scrupulous about my vaginal health and changed my sanitary products at least every four hours as recommended.

Candida Firsthand: Fast forward around 10 years. I'm in a sexual relationship and I get The Itch. I assume it's thrush, and get Canesten over the counter at the pharmacy and then carry on with my day. The thrush clears up for a while, but then it comes back. So I call the GP and they tell me to go to the sexual health clinic. To do this, I have to take annual leave to travel there in the opening hours. Even then, they only accommodated walk-ins, so I may not have been seen. If these barriers are not enough, I was also extremely embarrassed with the whole idea of going to a sexual health clinic. Eventually I saw a GP who gave me a swab and confirmed I did have recurrent thrush. My partner at the time laughed and told me that thrush was no big deal, which is probably because he couldn't catch it. Because my thrush was recurrent, the GP gave me a blood test for diabetes, which came back negative. There was no obvious cause, so I fell through the cracks a little bit. The GP had never asked about my environment. If they had, we probably would've figured out the cause pretty quickly.

Candida Firsthand: In the office my desk was positioned directly underneath the air con, and I really feel the cold. So the office administrator had very kindly given me a little heater to put underneath my desk. I liked to have it snuggle between my knees. Which created a really lovely, warm environment for myself and also for the yeast. At the time, I didn't put two and two together. I just carried on in discomfort for the next few months with the added expense of Canesten on my regular shopping list. There were other knock-on effects. My sleep suffered. My relationship suffered. My partner at the time really struggled with the reduction of intimacy. So on the nights when saying no wasn't worth the drama, I would spread my legs, close my eyes, and think of England, as the saying goes. For those who haven't had the pleasure, it feels like having sandpaper shoved inside that horsefly bite I described earlier.

Candida Firsthand: Several years later, I'm happily single. I work from home and can control my environment and I'm thrush free. I found thrush to be extremely isolating, and I hope that if anyone can relate to my story, that they find comfort that they are not alone. Thank you very much for listening.

EW: Uh, you know, I, I feel like that story really, it, it like exemplifies some of the shame that's surrounding things like yeast infections.

EAU: Yeah. I feel like no one wants to talk about yeast infections,

EW: And I know that I was gonna say like, literally every person

EAU: a

EW: with a vagina has had a yeast

EAU: 75% actually.

EW: Almost everyone. That is pretty much close to everyone. Yeah.

EAU: Yeah. Yeah. Thank you so much for sharing your story with us and everyone listening. We really appreciate it.

EW: Yeah. Thank you. Thank you. Hi, I'm Erin Welsh

EAU: And I'm Erin Allmann Updyke

EW: and this is, this podcast will kill you

EAU: welcome to Yeast Infections.

EW: And, I mean, yeast

EAU: It's, it's broader.

EW: Yeah. Well, I feel like, but it's all yeast or yeast like, and so it, it's we, yeah.

EAU: Candida.

EW: And not just Candida albicans, candida auris,

EAU: all the candida.

EW: other. Those are the only two I know right now

EAU: Don't worry. We'll get into it.

EW: um, I can't believe we haven't done this.

EAU: I can. Our list is simply too long. Oh, that was good.

EW: No, it wasn't.

EAU: Uh, our list is long and, um, you know, we're doing it now. That's all we can say.

EW: we're doing it now. I learned a lot. We're about to learn some more. Um, and we're about to tell you about a recipe for our quarantini

EAU: or

EAU: placeborita today?

EW: Burrito. Yeah, actually it is. You can make it a quarantini if you want.

EAU: Sure.

EW: It's called a

EAU: The candid shot.

EAU: The candid shot, or just a candid shot?

EW: Well, the only reason I was thinking a candid shot is because candid a. And then what happens to that? A, we just move it over. But the candid shot

EAU: you in your grammar. I like it. A

EW: I mean, thank you. Uh, a candid shot is fairly simple. It is like rose soda and rhubarb.

EAU: Mm-hmm. I was gonna say like, you just stand there and someone takes your picture.

EW: No, that wouldn't be candid.

EAU: No, you were right. It wouldn't. Anyways, you can find the full, very complicated recipe for that placeborita. And if you wanna add alcohol, a quarantini on our website, this podcast will kill you.com And our socials, are you following us on socials? Uh, Erin's making videos of these drinks

EW: poor, poor videos. Yeah, not very good. But they exist. So we're

EAU: know, new things. Um, Instagram, TikTok, Facebook

EW: website. This podcast will kill you. Dot com. Um, transcripts. Links to merch. Links to bookshop.org. Affiliate account links to good reads, list links to Music by blood mobile, the sources for each and every one of our episodes. Um, there's also embedded YouTube videos there, so if you check out our.

EAU: Oh, you've been doing that, Erin, look at you.

EW: Yeah. Sometimes I'm a little bit late because I have to wait for the day that they publish. It doesn't matter. They're there. Um, and some other things, a contact us form. Thank you everyone who has submitted your story for a firsthand account, uh, using our firsthand account form.

EAU: know it could be years before we contact you, but we read them

EW: but we do read them all. Yeah, yeah. Yeah. Uh, I think that's it.

EAU: That's it. You did a great job.

EW: Thank you.

EAU: Uh, do you wanna hear about the biology of Candida?

EW: course I do.

EAU: Let's take a break and get into it.

EAU: So the star of today's show is a fungus, and as we've learned in previous fungal episodes, fungi tend to be a little bit complicated.

EW: They, they do.

EAU: They really do. And in the case of candida, often people cite it as a yeast, right? We think yeast infection, and a yeast is a single celled fungus, right? Like the kind of yeast that you use for bread. But candida also exists as a filamentous mold with its little hyphy or sometimes pseudo hyphy branching out. So it's really quite multifaceted, and it might not be surprising that in part because of that candida can cause a really wide range of potential infections, not just vaginal yeast infections. There are several different species of candida that cause infections in humans, the most common of which is candida albicans. But there are, I think there's a push to group all of the other ones as like non albicans, candida. Or non, yeah, N-A-C-N-A-C-Y. Non-albicans Canada yeast. Anyways, um, and these actually, some of them have been growing in abundance and posing a growing concern to infectious disease specialists and in public health officials and infection preventionists in hospitals,

EW: Well, 'cause that's what I was wondering. So why would you, like, are all non albicans candida, uh, as pathogen, like equally pathogenic and problematic?

EAU: all of them tend to be more apt to resistance, which is one of the big concerns about them.

EW: Very

EAU: Yeah. So the kind of most notable ones, and there are more than these two, but kind of the most notable ones are candida auris, and we'll talk more about that later. And then what used to be called candida glabrata, but what is now has been reclassified as Nakaseomyces glabratus.

EW: Okay.

EAU: Uh, and I think that's also part of why they're saying call everything non. Albicans because it's like they've been renaming some things, which is important but also gets confusing.

EW: Yeah. Yeah.

EAU: and then also candida parapsilosis, so that's the other one. And all of three of these do tend to have more resistance to antifungals than candida albicans. And so we'll talk a little bit more about them. And you can ask questions and I might not have the answers, but for most of this episode, especially for the like pathogenicity part of things, I'm gonna focus on candida albicans. It is by far the most common, something like 90% of us are colonized right now as we speak on our skin or in our mouths, or in our vaginas or in our guts. 'Cause it can live there too. So candida is or causes what we often call an opportunistic infection, meaning that when the opportunity arises, it will cause infection. And when it does not arise, it simply coexists with us.

EW: Maybe even beneficial.

EAU: maybe though I didn't research that at all,

EW: That's okay. I have a paper.

EAU: love it. And it lives not just on our skin and in our mucus membranes, but also in the environment and mostly just hangs out there a little bit unobtrusive until it becomes a problem. I think of it as, um. Just getting too big for its britches and deciding to take over the place writing executive orders and all of the judges and other lawmakers are nowhere to be found. Can't keep it in check. Just kidding.

EW: I guess this is fine for me to take over like. No one's here. Like,

EAU: no one else is here. I'll just, I'll just move in.

EW: Yeah.

EAU: So let's talk about what kinds of problems it can cause because it's really varied and not all Candida infections are created equal. There are broadly two big categories of candidal infections. There's mucocutaneous infections, so skin and mucus membranes, and then there are systemic infections. You can

probably guess which one is more severe. The most, I don't even know if this is, I dunno if it's true to say the most common, but probably like the thing that I certainly, I think about and that most people probably think about with candida is a vaginal infection or vulvovaginal candidiasis, and we kind of said this already, but something like 75% of people with a vagina will have candidiasis at least once in our lives. Six to 10% of us may have recurrent vulvovaginal candidiasis, which is usually defined in the literature as more than four per year with resolution of the symptoms in between each episode.

EW: Okay. Not just like persistent, like, so, I mean, okay. That is the chronic part. Are there, how long, oh, okay. Nevermind. Am I getting ahead of things already?

EAU: You're asking a lot of questions.

EW: How long do the, does the yeast infection last? How long does treatment, how long does it take to resolve things? How long do p Does it? Yeah. Does it ever self resolve?

EAU: Yeah, certainly can, certainly can self resolve, uh, how long it lasts. Just totally depends on the person and their immune system, uh, and what kind of treatment they get. If they get treatment. Treatment depends on the situation. It can be topical, so sometimes we use like vaginal suppositories or vaginal creams or it can be oral and that's usually a shorter course, unless it's a more resistant strain or you have recurrence or something like that, then sometimes you need a prolonged course of oral antifungals.

EW: Um, okay. One real quick, one question. So for the people who have recurrent yeast infections, what is driving that recurrence?

EAU: Isn't that a great question?

EW: We dunno.

EAU: We dunno.

EW: Okay.

EAU: Yeah. What I can tell you a little bit about, since I haven't even mentioned it yet, is what the symptoms of a vaginal yeast infection are.

EW: Sorry.

EAU: That's okay.

EW: excited

EAU: love it. Erin. Don't, don't ever apologize for your excitement. Um, but again, most

EW: for, for other things. Yes. Yeah.

EAU: Um, most of us have probably experienced this. We can see inflammation. We see a white, chunky, cheesy kind of cottage cheese discharge, itching, burning, pain. And this is an infection that is very easy for people to dismiss. And by people, I mean the people not experiencing it in seeing it, but it has a substantial economic and morbidity burden. And we'll talk a little bit more about that later on in this episode. Um, the risk factors for like, why do people get yeast infections and some people don't, or when does someone get a yeast infection? Risk vectors can include poorly controlled diabetes. Um, sometimes we see associations with sexual activity, but it's not considered by any means a sexually transmitted infection. 'Cause again, this is like a commensal. Um, we also can see an increase in cases with increased estrogen states, so like during pregnancy and things. But by far the most common is antibiotic use. And that's true for a lot of candidal infections, not just vulvovaginal

EW: Right, right.

EAU: Um, but it's not just the vagina. Our other mucus membranes can often get infected, so we can see oral or esophageal candidiasis, which at least in the US we often call thrush, and I think that they call thrush. Like diff like a variety of candidal infections in other countries too. Um, but that is when you get infection of the tongue, the oral mucosa, the gingiva so your gums or your throat or esophagus. And you usually will see this kind of off white yellowish. It can almost be like, almost so dark that it looks kind of brownish or blackish, um, just depending on like how long it's been there and things. But this plaque that forms in the mouth or in the throat,

EW: Yep.

EAU: most of the time with these infections, we see them with some type of immuno compromising condition. So something like HIV aids or chronic steroid use, including yes, inhaled corticosteroids if you're not rinsing your mouth and that's why you're supposed to rinse your mouth after you use like a inhaler

EW: Interesting.

EAU: mm-hmm. Or conditions that cause like a reduction in saliva, which is gonna help to wash out the yeast that's in your mouth and keep it moving.

EW: what would that, what reduces saliva?

EAU: Oh, something like, um, Sjogren's syndrome, which is quite rare. But then there's other things that I don't know, other specific conditions where people might have less saliva or people who wear dentures, I think too are at higher risk of oral candidiasis. But we can also see it on our skin or in our nails. We can get intertrigo. So like in the skin folds, maybe say axilla, groin diaper rash for babies. You can get it on the penis. We call that balanitis. You can also get it on the nails. So either with like, uh, an ingrown nail, so we call that paraia or onychomycosis, which is like the nail infection.

EW: Is that like on on top of your nail or under your nail, or like how does that happen?

EAU: like within the nail itself 'cause Yeah, yeah. So yeah. Um, it's here, it's there, it's everywhere. So given the right set of circumstances, it can absolutely flourish and sometimes it can really go too far and cause a systemic or invasive infection inside of our bodies.

EW: Mm-hmm.

EAU: The most common and most serious of these invasive candidal infections is called candidemia, which is a bloodstream infection. So yeast growing in our bloodstream and this has a mortality rate of 30 to 40%, depending on how you calculate it. And that's today, and that's in high income countries?

EW: And that's with all the treatments

EAU: Exactly. Yep.

EW: Wow.

EAU: Um, and part of that is because of just how hard it is to diagnose and treat these infections, um, especially once they've gotten into our bloodstream, but also because the vast majority of people who end up with a bloodstream infection are very sick to begin with. So we see this really commonly in things like ICUs when people are already, you know, their immune systems are kind of

at their limit, um, and, and things like that. Once someone has an invasive candidal infection, they can end up with a number of other places that this canida infects their after. So you can get an infection in the eye and it can cause candida endophthalmitis, which can potentially cause permanent blindness. It can go into the heart and cause endocarditis, so infection of the heart and the valves of the heart,

EW: Okay.

EAU: it can get into the central nervous system. And we see this commonly in premature newborns. Something like 15 to 20% of the time. If a preemie ends up with invasive candidiasis, it will end up in their central nervous system. So with a meningitis or an encephalitis, I know. And then especially after surgeries or other like abdominal procedures, people can get abdominal candidiasis and that can result in like a fungal abscess, um, or can sometimes infect the liver or the spleen. And in those cases can sometimes cause a really prolonged infection that's really hard to treat.

EW: Do we have a more granular answer as to how this happens? Then there's a breakdown immunosuppression and things just sort of spill over.

EAU: a good question, not, not a super more granular one than that. There's always, I mean, almost always there's gonna be some, I say almost just a hedge, but realistically there's always gonna be some kind of like precipitating events, right? Whether it's some other infection, whether it's, you know, a bone marrow transplant, a solid organ transplant, you're on immunosuppressive drugs. Um, you have, you know, hiv aids, like you are born with an immunodeficiency. So many potential conditions that lead someone to be more susceptible. And then it's like those right set of circumstances. The other thing that's very commonly predisposed of someone to an invasive infection, especially a bloodstream infection, would be having indwelling lines. So if you have ports, if you have catheters, um, as we'll see, candida forms biofilms very easily, and so they can colonize and form a biofilm on those indwelling lines and then put you at risk for invasive infection because it's just. Bopping off little yeasty from the biofilm.

EW: I feel like, so on this podcast. We have talked about a few other opportunistic pathogens that tend to just hang out and then crop up when something is a little bit out of balance. There's a dysbiosis, whatever, and I do, we know why candida rather than, uh, staph aureus or why candida rather than strep? You know, like, what is that deciding factor?

EAU: I don't, well, I don't think it's always an either or.

EW: Sure. Of course not.

EAU: Um, but yeah, I, I don't. I don't know. It's a good question. I mean, and it, and it could be any of those. So it might just depend on that individual, what is their skin more colonized with? What do they happen to have on their bodies? What other antibiotics are they being exposed to? What happens to gain that foothold to begin with? Or what other, you know, because our immune systems respond to bacteria and to fungi in different ways. So what type of immuno compromising condition do you have, and does it leave you more susceptible to fungus because your immune system's just not as good at getting at that fungus versus a bacteria or something like that. Are you already on all the antibiotics possible and so you've killed all those and now only the yeast are left?

EW: Yeah. Yeah.

EAU: And as a fungus, candida is already, in some ways kind of harder for us to fight off compared to some bacteria because it's a eukaryote rat, right? So it's, it's a little bit closer to us. So it's harder for us to have antifungals. It's harder for our body to recognize it sometimes. However, candida is also special and has quite a number of virulence factors that facilitate its ability to infect us and cause disease. For one thing, it can do that switching thing that I mentioned at the top. It can exist as a yeast or as this filamentous hyphae form, depending on its environment. And this allows it to disseminate widely when it's a yeast, right? It's really hardy. It can exist in the environment. It can beep, bop, bop between people, and then it allows it to invade through our epithelial barriers when it's in its hyphe form. And then that also allows it to evade a lot of our immune responses.

EW: Okay, so the hyphal forum does impact our immune, like it's immunogenicity or something detection.

EAU: Majorly. Majorly. And so it's really the hyphal form that we tend to see that that ends up being the reason that we have invasive disease,

EW: And so are all candida albicans individual, you know, cells or whatever capable of this transformation.

EAU: as far as I know. Yes. And there are differences. And it does seem like the switching part of it is what makes them so good at causing disease. 'cause

when you breed strains that are only hyphal or only yeast, they're not quite as good. Um, but in general, they all can do both. They're quite. Aept like that.

EW: Hmm.

EAU: Candida also has a bunch of proteins that we call adhesions, which I feel like we've talked about this, who knows on what episode. Um, but they're basically sticky proteins that allow it to make these biofilms and to colonize places like our skin and mucus membranes. And also things like catheters, PICC lines, like all of these lines that especially if someone is already ill and in the ICU, they usually have quite a lot of lines, um, and a biofilm for anyone who's forgotten the glory that is biofilms, they're these really complex assortments of a bunch of different microorganisms that end up forming their own protective barrier. This little extracellular matrix that completely blocks our immune response from accessing them, which means that they can continue budding off these little yeasty or having their little filamentous forms just kind of creep out and go invade deeper into our bloodstream, for example.

EW: Where did we, was it Legionnaire's disease where we talked a lot about biofilms?

EAU: In Legionnaires, but something since then too. 'cause that was a long time ago, but I can't remember. I can't remember what it was. Someone else do you remember? Probably have a better memory than us. Um, but lastly, they also have a bunch of enzymes that they can secrete these, this fungus to help break down our endothelial cell bar barriers and damage our cells and hide from our immune system. And what's so fascinating is that part of the way that Candida does this is actually by recognizing some of our metabolic cues. So they're sensing what's going on in their environment, AKA, in our bodies, and changing the way that they grow, changing the structure of their own cell wall. They are just really, really well adapted to our human bodies.

EW: Hmm. Mm-hmm. Mm-hmm.

EAU: Probably the two biggest challenges when it comes to dealing with candidal infections, especially the severe ones, but even, you know, mucocutaneous infections, which I'm not saying those are not severe just in comparison to bloodstream infections. Um, its diagnosis and treatment and the diagnosis of Canada is really challenging, in part because the gold standard is to grow it in culture. And these grow really slowly, they take a really long time to grow in culture, and our culture methods are imperfect. So if you have, say, a

low abundance, you might get negative cultures, even though you have plenty of yeast growing in your body.

EW: Well, and then how do we, because it's a commensal and it's on, you said 90, over 90% of people, how do we know whether detection of candida is a problem or like regular growth or overgrowth?

EAU: question. So yeah, you can have false positives and false negatives both directions, right? Depending on exactly what site you took it from, depending on how you took the samples. In general though, it does not belong in our blood. So if Canada is growing from a blood sample, yeah, but you're right. If it's from like a skin sample, is it overgrowth or is it not? And some of that comes down to like clinical diagnosis as well too. What do things look like and stuff

EW: what are your symptoms? Are you experiencing discomfort?

EAU: Exactly. Exactly. Um, there are PCR methods and things, but they're not always available. Um, and then treatment is hard in part because of the toxicity of a lot of drugs that we use and because of increasing antifungal resistance.

EW: Yeah. Yeah.

EAU: Yep. Uh, that's it. I could talk a little bit more about the details of the treatment, but it's, it's a little bit boring and niche so.

EW: Well maybe there'll, there are times when I talk about treatment in the history and so maybe then we can

EAU: There you go. if you have questions.

EW: if there are gaps.

EAU: So tell me, Erin, about the history of this, uh, low fungus, won't you?

EW: I will. I will.

EW: modern society,

EAU: I simply love when episodes start like this, Erin. I just love it. Keep going

EW: honestly. Sometimes I like, I write this and then I read it over and I'm like, why did you write this? And it's too late now. Here we are,

EAU: because it's great. That's why keep going.

EW: modern society. Is blamed for a whole host of diseases and disorders, depression, and other mental health disorders, uh, certain kinds of cardiovascular disease, metabolic dysfunctions, even allergies and asthma. To some extent, this is not a novel concept. The industrial revolution in the 19th century sparked intense discussion over how things like long working hours and stress, poor nutrition, lack of sunshine, and education for women contributed to the rise in, you know, these nervous disorders like neurasthenia or hysteria. Setting aside the problems with some of those diagnoses, especially neurasthenia and hysteria, and whether their relationship with modernity can truly be described as causal, I think that this idea of diseases of modernity captures a reality that we sometimes struggle with, and that is that progress comes at a cost. Most of the costs that people are concerned with are general or hard to quantify, just as like a feeling that we have. So for example, our computers are capable of more than we could have dreamed of. And at the same time, we are more sedentary and overconnected than we have been in, you know, for most of human history. Contributing to chronic and mental health conditions. Have things improved overall, thanks to computers? Are computers a net positive? Absolutely. Like there's no doubt about that, but we can also consider the cost factored into that equation.

EAU: A hundred percent.

EW: And I think that we are especially prone to thinking that science and medicine moves in one direction, more knowledge, more treatments and cures, better healthcare (when it's not being thwarted by uninformed disinformation spreaders like RFK Jr and his ilk). But unfortunately, this forward progress, it's not always the case, or at least there's a more nuanced story to tell. Sometimes it's more of like a two steps forward, one step back kind of a thing, and rarely are we able to predict what that backward step might look like. This was certainly the case with antibiotics and no, I'm not talking about antibiotic resistance. I mean, people did. That is a step back and people did see the writing on the wall almost immediately when they came out. But I mean, candida.

EAU: Oh my gosh, I love this.

EW: Yeah. When penicillin came onto the scene in the 1940s, quickly followed by other antibiotics such as streptomycin in the 1950s, they led to a revolution

in healthcare. It's a powerful story that we all know well, and if you don't, you should check out our antibiotics episodes from years back, but the miraculous recovery of patients on the verge of death from a bacterial infection, that's just one of the transformations brought about by the advent of these drugs. The other was candida changed from a mostly benign, which is not to say it wasn't uncomfortable or caused issues, superficial fungal infection to a sometimes invasive systemic disease, and ultimately it led to a few fringe doctors promoting an unsupported hypothesis that to this day, is used to sell people's snake oil supplements that can harm much more than they can heal.

EAU: Oh, I'm so shocked to hear that.

EW: I got so like, just frustrated with this episode anyway, and

EAU: I bet.

EW: But before we can tell the story of that transformation, let's first go back in time to the early history of Candidiasis. Of course, it's Hippocrates, like it's always Hippocrates.

EAU: get a little sad if there wasn't, because I was like, gosh, is this only gonna be a modern thing? But like, no, it must have been around forever.

EW: been around for, it's been around forever.

EAU: Yeah. Yeah,

EW: yeah.

EAU: it's our friend. It lives with us. Yeah,

EW: Sometimes it's like, you know, a little, not even codependent, but just like dependent

EAU: right. A little much. You're like, ah, stop calling me. Stop calling me. It's too much.

EW: not disturb mode. Just like, yeah. Ah, okay. Hippocrates, in one of his classic texts, he describes thrush, uh, like oral thrush is what I'm referring to, particularly in people who are already sick or in poor health. Uh, Galen also made mention of thrush, especially in sick kids, and there's a smattering of

mentions throughout the 16 hundreds and 17 hundreds where thrush, it thrush really is what predominates throughout history. And that's understandable because, yeah. Um,

EAU: ' cause it would've been there and no one was gonna talk about vaginas.

EW: course not.

EAU: Yeah.

EW: no. Uh, but it was actually, thrush was recognized as relatively common in newborns and apparently so common in France, that in 1786, a medical society offered a reward for its study.

EAU: Oh, interesting.

EW: Yeah, outbreaks of thrush were known to happen at lying in hospitals where people came to give birth and then spend some time in recovery afterwards. And so there would be like outbreaks throughout the

EAU: Mm-hmm.

EW: And in the 18 hundreds is when the many faces of candidiasis or candida began to be noted esophageal vaginal. So the first vaginal yeast infection was clinically described in 1849

EAU: That's so late.

EW: and published in The Lancet.

EAU: Wow. Okay.

EW: Uh, mouth lesions, brain lesions, even intestinal disease. Even some systemic infections. Disentangling what caused these infections was much more challenging, especially when this yeast can, you know, overgrow or cause infections on so many different parts on the body, in the body,

EAU: Mm-hmm.

EW: Or when there are like moral or ethical considerations. Like doctors were reluctant to examine women and even when a doctor did conduct an exam and

found a yeast infection, they were like, oh, it's just a symptom of another disease. It's not a condition in its own. Right. Yeah.

EAU: so interesting. Okay.

EW: I mean, but similarly, oral thrush, you know, you talked about how it can almost be like brown. It was recognized or thought to be the precursor to diptheria in a lot of cases because that that thick membrane as well. Mm-hmm.

EAU: Okay.

EW: And in some cases the infectious nature of these lesions was suspected or like couldn't really be ignored. It was like, well, it has to be infectious. And in other times it was the infectious nature was proven by experimental infections. One of which, at least one of which led to an infant's death healthy infant. Let's just infect a bunch of these with this and see what happens. And one died. Isn't that absolutely horrific?

EAU: horrible. This was in the 18 hundreds.

EW: Hundreds. Yeah.

EAU: Oh God.

EW: Um, and you know, I think that around this time when germ theory rose to prominence, it reinforced this idea of. One microbe, one disease, one cause one disease kind of a thing where one pathogen was responsible for one infection in particular, which is great for diagnosis and developing treatments or vaccines. But at the same time, it made it harder for people to realize or recognize when something didn't fit that paradigm such as candida, which by this time, let's say by the, uh, early 19 hundreds, went by a million different names. And so for the full picture of what Candida was capable of, we needed someone who was able to look past the trees to see the entire forest. And that's someone turned out to be Rhoda Benham, who later became a leader in the emerging field of medical mycology. In a 1931 article in the Journal of Infectious Diseases, she put forth the idea that all of these diverse infections from mouth to vaginal, to intestinal, all of these different things, each of which had been attributed to different fungal species with like different names. 'Cause they were like, oh, we isolated this from the mouth. Oh, this came from the, the fingernail. Right? It must be this different thing. Um, it actually just came from one species, one organism, which at the time was Manila. Um, albicans later turned into Canada albicans, which also did you know, means whitening white. Like it's like

EAU: I did

EW: white. White,

EAU: White. White, I mean, does tend to have white cheesy ness

EW: Yeah, exactly. She wrote, quote, "if one were ignorant of the source of these cultures, one would be unable to distinguish, for example, M albicans isolated from thrush from M. psilosis, isolated from sprue. And it would seem necessary for the present to regard such forms as merely strains of one species." End quote.

EAU: There you go.

EW: In other words, like,

EAU: just look. Look at it. They're all the

EW: it's all the same. Stop calling these things different names. It's the same thing. It's the same thing. Uh, which was a pretty like novel idea. I think for like the, the concept that this thing could be cause infections in such diverse, basically everywhere in the

EAU: Mm-hmm. Mm-hmm.

EW: It's a new idea. And so at this point, let's say the 1930s or so, Canada had caught the interest of a few re researchers, but to be honest, it was more of an afterthought, like not super pressing. It was like there were a lot of other things that people were concerned with at the time. Wasn't the hottest thing,

EAU: Okay.

EW: but the birth of the antibiotic era was about to change all that. By the 1950s, antibiotics had saved countless lives around the world. But the excitement that had accompanied the emergence of this new class of drugs was beginning to be tempered by a few unexpected consequences. New antibiotic resistance strains causing infections that couldn't be treated. Allergic reactions, toxic side effects in some of these, and a rise in candida infections, both superficial and invasive in those receiving antibiotics. And this last observation led the counsel on pharmacy and chemistry of the American Medical Association to release a statement in June of 1951 that said that bottles of, uh, the three leading antibiotics should carry the following warning. "Patients

receiving these drugs may be more susceptible to manilal or other yeast like organisms."

EAU: Wow.

EW: Yeah,

EAU: back when.

EW: way back when, and it's interesting, this is, this was not without controversy, right? Because first of all, it was hard, I think for people to draw the connection between how were, how exactly were antibiotics causing this greater susceptibility, and secondly, since Canada is a commensal of humans, how do you distinguish between what is a harmless or a harmful overgrowth? And thirdly, what are we supposed to do about it?

EAU: right.

EW: Right? At that time, 1951, no treatment, but within a few years, that last question, what do we do about it would be answered 1954 with the first antifungal on the market, nystatin, which is the market name, myostatin.

EAU: Mm-hmm.

EW: This was developed by Elizabeth Hazen and Rachel Brown a few years before. I think it was like in production, and then by 1954 it was on the

EAU: Okay.

EW: Most of the antibiotics then available were derived from fungal species like penicillin, which had used these compounds to compete with bacteria. Like I feel like Yeah, it's, it's, I just love, yeah. And so using that same logic, nystatin was developed from a bacterium, streptomyces norcia found in soil from a friend's garden, like one of their friend's garden. And because Hazen and Brown reasoned that soil was this battleground for all sorts of microbes, they're all like, let's bring out the big guns. You know what we're gonna, here's this compound for this and this compound for that, and I'm gonna outcompete you and I'm gonna just destroy

EAU: you gotta think ecologically. I love it.

EW: matters. Like, uh, and so that's, yeah. Voila. There you go, nystatin. Mm-hmm. And then, but the other two questions sort of like, when is candida a problem? And, um. What, why is it doing this? Those proved a little bit more challenging to answer clinical evidence was mounting that while antibiotics were associated with systemic and deadly infections with candida through disrupting the microbiome, these weren't as common as initially thought. And it might actually have been a combination of our detection methods improving for this. And so that being partially responsible for the apparent rise, both in systemic as well as superficial. And by superficial I mean like on your skin surface mu exactly. Infections. But the important lesson was that antibiotics could disrupt someone's microbiome, which provided Candida an opportunity to grow more than it ordinarily would, and that disruption could happen from other things besides antibiotics. I. For most people, any yeast infection would be handled relatively simply through an antifungal like Nystatin, and then some of the later ones that came onto the scene. But for some such as those who are immunocompromised, that microbial dysbiosis, regardless of whether it was triggered by antibiotics or not, could result in more invasive and difficult to treat infections. And candida ended up around this time, let's say the 1970s and eighties being labeled a quote unquote, a "disease of the diseased", which is like, not maybe the nicest way to put it, it's not the best way to put it, but I think what it does is it conveys that this was an infection of disruption, something that would become even more clear in the 1970s and eighties in these decades with more patients in ICUs, you know, as healthcare and our ability to help people improve overall, we had more people who were, you know, alive in a

EAU: keep people alive even as they got sicker, and that comes with its own set of problems and complications.

EW: And then things like organ transplant, also, you know, people who were on immunosuppressive drugs to prevent rejection. Organ transplant was a very relatively, very new thing, not just relatively new. Um, and so, and then in especially in the 1980s, the rise of the hiv aids pandemic. And Candidiasis, you touched on this a bit, but it was especially a problem for people with HIV aids and one estimate suggested by that, by the mid 1980s, 75% of people with AIDS had oral candidiasis, and that, of course had the potential to become more invasive, uh, because their immune systems were so suppressed. And fortunately, by that time there were newer antifungal drugs that had come on the scene that were usually quite effective in treating these infections. Um, and their development was in part, motivated by the spread of this yeast, but the increase in awareness that Candida received during this time, it also inspired a different movement, one not entirely grounded in scientific evidence. In 1982 and 19 83, 2 books came out claiming that Candida was a, the cause of a host of poorly understood and ill-defined physical and mental health issues. One book was

titled The Missing Diagnosis By, or Orian Truss, and the other was The Yeast Connection, A Medical Breakthrough by William Crook.

EAU: Okay.

EW: Literally

EAU: The name,

EW: Crook.

EAU: Okay. I mean, I guess you don't have control over that, but.

EW: You don't. Yeah, it just is. It just was funny to me. Um, and the overall premise of both of these books were that many people were unknowingly living with a chronic overgrowth of Canada, which led to an overall more immunosuppressive state and predisposed them to a variety of conditions ranging from tissue injury and mucosal infections to mental health issues.

EAU: Oh,

EW: A self-diagnosis checklist was included along with a nine step program with also many substeps for treating this alleged overgrowth. Diagnosis was confirmed only with a positive response from the nine step program.

EAU: What were the nine steps? Were they

EW: Okay. Do you want me to find them?

EAU: and

EW: Um,

EAU: things that will make you feel better?

EW: yes. Exercise was one of them. euh... the A diet was another. Okay. Here we go. I found it. Um, continuing observation in order that concomitant diseases can be detected accurately diagnosed and specifically treated exercise program, mental health program, avoidance of chemical pollutants.

EAU: Okay.

EW: Maybe there's more information in the book

EAU: does that mean? Don

EW: The use of antioxidants,

EAU: Okay.

EW: use of special laboratory tests like the ratio of helper cells to suppress her cells, blood vitamin studies, mineral studies and hair, blood and urine. Amino acid studies in urine. Essential fatty acid profile. That's step six. Right. Okay. Um, special dietary program. We'll get into that in a second. Um, including supplements. That was one of on here. The use

EAU: get from them.

EW: Yep. The use of antifungal agents for months. Topically and orally. Mm-hmm. The use of allergenic extracts of candida albicans for immunotherapy or provocation neutralization.

EAU: Okay.

EW: Um, that's, yeah, that is, that's nine. Yeah.

EAU: Okay, Erin,

EW: So

EAU: so you do all these things at once, so you have no idea what's helping.

EW: you do all these things at once. Right, right. It's not, as far as I can tell, it's not a stepwise thing. Um, yeah. Okay. So just to give you a better sense of like the picture of this, I'm gonna quote from Truss's missing diagnosis. Quote, this is just a, this is just excerpted. There's a lot more where this comes from, quote, "depression is common, often associated with difficulty in memory, reasoning, and concentration. These symptoms are especially severe in women who, in addition, have great difficulty with the explosive irritability, crying and loss of self-confidence that are so characteristic of abnormal function of the ovarian hormones. Poor end organ response to these sex hormones is confirmed by the common association of acne, impairment, or total loss of libido, and the whole range of abnormalities of menstrual bleeding and cramps, as well as a very high

incidence of endometriosis in those who have undergone hysterectomy. Many of these patients also start developing multiple intolerances to foods and chemicals, making it increasingly difficult for them to live In a normal environment. Many or all of these intolerances disappear as the yeast problem is brought under control." End quote.

EAU: What.

EW: Um, okay. So yeah, bringing it under control. I went through the nine steps there. It's a, a lot of it's that, uh, long term, not, not just antifungals though also antibacterials were prescribed like antibiotics.

EAU: For what?

EW: Yeah.

EAU: Okay.

EW: Mm-hmm. Mm-hmm. Um, candida extracts that one for immunotherapy and this anti, the anti candida diet. So there's a lot to unpack here. So first there's the vague and diverse array of symptoms of what was termed Candidiasis hypersensitivity syndrome, and then women being called out in particular because of something about like sex hormones. It was unclear to me from that,

EAU: What any of that meant? Yeah. And like why does that have anything to do with candida?

EW: Mm-hmm. Mm-hmm. Um, birth control was also blamed

EAU: course birth control has been blamed pretty commonly. Like realistically, you're on, if even if you're on an estrogen containing birth control, you're probably having lower estrogen levels on average than you would if you were, well, certainly if you were pregnant, but also than if you were like cycling. And so there isn't really a good association between, there is a site association between like menopausal hormone therapy and a slight increase in yeast infections, but even that is not like major.

EW: Right. And also we're talking about yeast infections,

EAU: Vaginal yeast infections,

EW: whatever this is. Yeah, yeah. Um, and I like the, the other symptoms are, like when I said earlier that like, these are really vague. In general, it's things like headache and malaise, so things that people do experience probably regularly in associ, in association with, who knows what many different

EAU: I mean, it just definitely feels like this is something that's preying on people who haven't found an answer from somewhere else.

EW: Literally that's what I have down here. Yeah, we'll get, we'll get there. But I wanna tell you about the diet too, because like, I think that this is still incredibly, incredibly popular. So the diet requires strict adherence and is, is incredibly limiting. So there's no sugar at all. Even fruit, like you can't have fruit,

EAU: Oh my God. Okay.

EW: uh, no pork, no gluten, no popcorn, coffee, nuts, mushrooms, truffles, no alcohol. Many grains are excluded. Um, but fresh and organic meats and fish, but again, no pork are allowed.

EAU: Why no pork?

EW: Um, something about pork, well, allegedly according to this, pork contains some sort of retroviruses that Yeah, yeah. Like vet retroviral something,

EAU: I'm not like pro. I mean I love bacon, but I know it's terrible for me, but like it's not causing candida.

EW: It's not. It's not.

EW: And these books though, and the idea that they promoted became wildly popular, like selling out book prints or whatever, and leading many people to seek months of systemic and topical antifungals from their doctor. They discontinued birth control and they started to take a suite of supplements that were probably not great. Actually there have been a few cases of people who either go on the diet or start taking these supplements that end up putting them in a hospital or they're on these antifungals for so long. Anyway, so this, it got to a point, it got to be such a problem that by 1986 or in 1986, the executive committee of the American Academy of Allergy and Immunology released a statement listing their critique of the Candidiasis Hypersensitivity syndrome. And I'll link to this 'cause it has like almost like a point by point refutation. And their ultimate conclusion was that quote, " on the basis of the evidence so far

reviewed and until appropriate published evidence to the contrary is brought to its attention. The Practice Standards Committee recommends that the concept of the Candidiasis hypersensitivity syndrome is unproven." End quote.

EAU: I mean, pretty straightforward,

EW: It didn't really do anything. Over the next decade, though researchers like started to look into this with carefully designed clinical trials. 'Cause they're like, if this is the thing, this is, we have a path forward,

EAU: If this is real, let's figure it out so we can treat it well.

EW: They tested the anti, the anti candida diet. Uh, they, there was a test, uh, or a, a trial with prolonged treatment with Nystatin and also looking screening for candida throughout the body. No strong evidence emerged for the condition. And if you look, uh, candidia as Hypersensitivity syndrome, uh, on Google Scholar. You'll find a few papers from the eighties and early nineties, but anything that's more recent tends to come from things like the Candida clinic or like the candida, whatever sort of candida Pro pro, this idea,

EAU: like they have an angle cause they're trying to sell you a supplement.

EW: Supplement or something. Yeah, a book.

EAU: Mm-hmm.

EW: But, um, and, and in fact 'cause like one of the ideas that they promote is that, okay, you need to like for, and why the diet is there, is that it cuts down candida in your gut. And there's actually a paper from 2022 that suggests that candida in your gut is a mutualistic beneficial bacteria or a beneficial organism. And it's a sign of a can be a sign of a

EAU: A healthy gut. I mean, you want your gut microbiome to be quite varied.

EW: Yes, you do. You do. Um, but yeah, nevertheless, this persisted this idea of candida overgrowth or candidiasis hypersensitivity syndrome, and you've got countless organizations, supplement companies and forums dedicated to spreading the word. And why it has remained so popular, I think comes down to two main things. And the first is that is what you touched on.

EW: Medicine doesn't have all the answers and people seeking help are sometimes dismissed or have their questions ignored and their concerns

ignored. And I don't doubt that people who think they have this condition or are experiencing symptoms of candidiasis overgrowth or candida overgrowth are probably experiencing uncomfortable, disruptive, or even debilitating symptoms. But so far no evidence points towards candida as the culprit. Doesn't mean that someone isn't having headaches or digestive issues, but that it's probably not Candida. And the Candida diet probably helps because you're paying attention to what you're eating. You're, you're cutting out a lot of things that probably don't make you feel great, right.

EAU: It would be great if we could all cut out sugar

EW: Yes. Probably. I mean, yeah, there are some, or at least some, yeah, at least tone it down a bit or like some elements, but like not, yeah,

EAU: although not. Fruit

EW: not fruit. Yeah. Yeah. I eat so much, so many blueberries.

EAU: I know that about you.

EW: Yeah, it's one of my absolute favorites. I mean, it's why I love Costco just

EAU: just for the blueberries, everything

EW: clamshells. Yeah, fistfuls of blueberries. Um, but, but again, these, just because you're receiving a benefit or feel better from the candida diet doesn't mean that your candida levels are changing. In fact, there have been studies that indicate that there is no change. And honestly, it would be great if it, if it were candida. Wouldn't that be nice? Because there'd be, here's, here's the straightforward answer. There's probably a straightforward fix there. This is what we can do. People who are desperate for answers, desperate for relief, may find themselves looking outside of medicine for someone to tell them what's happening. Which brings me to the second reason why I think this has remained so, so popular. It's because there are countless people who are happy more than willing to profit off of

EAU: I know.

EW: There was one, I just, I googled anti candida supplements just to see what was out there, and it's like endless options, of course. And I just, I am, I'm so livid. Like livid isn't even the, the right word. I'm just so exhausted by the fact that this is a thing that is continuing to grow and grow and grow. There was one

supplement business, and I won't name the name of it, but it popped up as one of the, the, the, the companies when that's selling these anti Candida supplements. And I looked up, okay, what is their net worth? What is their income? What do they get every year? Tens of millions of dollars every year for "medicine backed" quote unquote. Absolutely not. Medicine backed cleanses that promise to restore gut health or make you free from Candida.

EAU: I, Erin. I mean, it all just makes me wanna do a whole nother supplements episode because there's still so much more there.

EW: It's, it's even like when we did that, what last year?

EAU: Yeah. Was that last year already?

EW: It's, it's

EAU: I

EW: worse. It's growing and growing and growing.

EAU: there're also, I've been been looking at this a lot lately. There are so many. 'cause you said these, a lot of these people who promoted this idea back in the eighties were physicians.

EW: so is the person who has the supplement.

EAU: Right. That is what is on the social medias right now, which I won't call out by name, but like almost every very prominent, even physician, influencer or whatever, sells at least one supplement or has advertised for at least one supplement or whatever. And it just makes it like. Ah. It makes it so, so, so hard. 'cause you just can't, and it's not, like we said in our supplements episode, it's not like supplements are evil. It's not like they're all bad, it's just that they're completely unregulated and so many of them are profiting off of Miss and disinformation.

EW: I mean, yeah. In, in terms of the morality question, I, I feel like it is pretty immoral to manipulate people and put fear into them to sell, to make money, to make yourself richer.

EAU: hundred percent. But I just meant like we do use supplements in medicine

EW: Yes, yes. And it, we're painting with a broad brush here, but I think that like when we're talking about someone who's taking a supplement to reduce their candida levels. Absolutely

EAU: There's no evidence. There's no evidence. Yeah.

EW: It's all, it's all, yeah. It's, um, predatory, predatory garbage. So, um, yes. And then I think the other issue with this, sorry, I didn't really mean to get this like,

EAU: I love it. I, I got you into it, so keep coming.

EW: but there's, you know, I was also looking up, I was just curious because especially yeast infections, I have heard so many different home remedies, and you've got people who are like, put a, a clove of raw garlic, cut in half, tie it around a string, uh, just coat it in. Yogurt coat, just like shove a bunch of yogurt up your vagina that'll get rid of it. Um, a jade egg or whatever, you know, like I'm sure that there's something on that, uh, website that we Yeah.

EAU: yeah.

EW: Disapprove of. But all of these things, like, they're misguided and it is. It just, it reveals so much of what is wrong with expertise, medicine, people being missed by medicine. Um, and like our limited capacity to answer all these questions.

EW: Probiotics, do they work? Maybe, maybe not. That question we cannot answer right now. What is even in a probiotic, right? Which bacteria matter in what quantities, which don't matter. Each person is unique. Their microbiome is unique. I mean, we don't even have, like, you know, I was thinking about this in like an actual puzzle and you know, you always put the edge pieces together first. Like, we're still flipping over pieces. Like we're not even close

EAU: so true. That's so true. We don't even know how many puzzle pieces we're dealing

EW: Absolutely not. Could it be a 1000 piece puzzle or like a 100,000? Yeah.

EAU: That's so true.

EW: I think that, yeah, I think that the, the fact that the anti, the anti candida diet and these alternative approaches to treating yeast infections, just as an

example, the as are, as prominent as they are, I think speaks to the failure of medicine to adequately meet people's needs. Uh, the disgusting greed and lack of regulation that allows people to sell snake oil on the basis of fear and lies. And also I think it shows the very human tendency to want answers, to want to take action. And Erin, I I'm sure that, you know, things have improved or maybe there's reason to hope good news on the horizon. Sorry to end this so depressingly.

EAU: Oh, that's okay. I don't know that what I'm gonna say is gonna be any less depressing, but we can get into what the landscape of Candida is like today.

EW: Let's do it,

EAU: Okay.

EAU: So when it comes to, I'll start with invasive candidiasis, um, because that's obviously the most severe forms of candidiasis. We're talking systemic infections. Um, a nature reviews disease primers from 2024. Reported an estimated community-wide incidence rate. So if you're just looking at general population, you might think it's not that bad. It's around four cases per 100,000 people in high income countries. Ah, not that bad. But you would be wrong if you thought of it that way because this is not a disorder, systemic, invasive candidiasis, that is particularly prevalent amongst the general population. But in hospitalized patients worldwide, we see about a hundred cases per 100,000 hospital admissions. And in the ICU an estimated five to seven cases per 1000 ICU admissions. In newborn babies, especially premature newborn babies, we see 12 cases of invasive candidiasis per 100,000 births of premature babies in the us.

EW: Wow.

EAU: So this is a disorder, a disease that for most people who are listening or walking around, like on your commute to work, if you're hearing this, you might think it's not that common. But if you work in a hospital, if you're unlucky enough to end up sick in the ICU, this is a very serious and seriously common problem. And with the rise of other strains of Candida, like Candida auris, which was first found only in 2009, it's a very, very new, newly identified pathogen.

EW: Yeah.

EAU: This is a species that was first identified in Japan, and since 2009 has been found in more than 30 countries. It spreads really rapidly through hospital settings, and it really rapidly gains resistance. A lot of times the, the different strains of C. auris have resistance to begin with, but then it picks up new resistance. So we see pan resistance, we see resistance in C Aus, some strains to almost all of the antifungals that we use, and it's been in the US since at least 2013. And according to the CDC in 2023, there were 4,514 new clinical cases of C auris in the US in 2023.

EW: Oof.

EAU: And it's been increasing. Like when you look at the graphs on the CDCC Aris page, it is like, whoop, whoop, it's exponential growth right now. It is. Whew.

EW: Yeah. Well, because it, it gains a foothold, I feel like, in hospital settings so easily too, where it's just like you can't get rid of it.

EAU: Right, right. Um, and that's not the only species that is of increasing concern. Um, candida parapsilosis, um, is a whole species complex that is also found really commonly. It's not like a new infection per se, but we are seeing increases in fluconazole resistance, which is one of the main, uh, antifungals that we use, especially for like mucocutaneous infections and things like that. We also are seeing increasing rates of what is now called Nakaseomyces glabratus, which used to be Canada Glabrata. Um,

EW: went, rolled right off your

EAU: thank you. I practiced so much, like every time I wrote it, I practiced saying it out loud. But this, we also are seeing both increasing in distribution. It's like the second most important species in the United States and in Northwestern Europe. Um, but infection tends to be more severe and it rapidly requires resistance compared to Canada Albicans, which tends to, it's not like that you can't have resistance, but it's just for whatever reason, not as good at acquiring resistance genes. Um, so there's a lot of different species that are kind of, of concern and that are on the rise. When it comes to vulva, candidiasis.

EAU2: Which we talked about already affects 75% of people with vagina at least once. Literally so many of us, but even recurrent vulvovaginal candidiasis affects an estimated 138 million people with a vagina every year worldwide, and it's on the rise and estimated to hit close to 160 million by 2030.

EW2: A couple questions. You said this is four to five times a year?

EAU2: At least four recurrent infections a year. Some papers, uh, uh, call it at least three recurrent infections a year, but most, most of them are four.

EW2: Um, okay. A quick question before we talk more about yeast, about vaginal yeast infections. The other species that you mentioned of candida, do they tend to colonize the same or like cause infections because albicans is a commensal, but these don't seem to be commensal. They seem to be pathogenic, or are

EAU2: The, yeah, so with Candida auris it's so new that I don't know that we know. It like, you know, it wasn't ever found before. So has it been, you know, certainly it can colonize our skin. I think it's estimated that like 10% of people, if you just like screen people coming into a hospital or something like that, 10% of people who are colonized will go on to develop an invasive infection. So it's not like it causes infection in all of them. And same thing with, you know, what is now Nakaseomyces glabratus and Parapsilosis, why is that one harder than

EW2: Yeah, the other ones you're like,

EAU2: Right? And there's also, there's more too, right? Like there's other candidal or what used to be candida and are now, you know, reclassified. So most of these can be found on some percentage of the human population just as commensals.

EW2: but in terms of the infections that they will cause it's the same sort of suite. Of

EAU2: In theory. In theory, yes, they could, but because I think because especially with C auris, we are screening for it in, we are seeing it more as an invasive infection.

EW2: Okay.

EAU2: because, and what does this just come down to? The fact that Canada albicans is still the most prevalent. So if there's going to be an overgrowth, it's going to win out in most cases. I don't know certainly what, uh, what used to be Canada Glabrata and is now Nakaseomyces glabratus it, it causes quite a lot of vaginal yeast infections. Um, and we see, you know, parapsilosis as well. So we see all of these, but still overwhelmingly albicans is the most prevalent.

EW2: So if recurrent yeast infections are on the rise, vaginal yeast infections are on the rise, are they caused by albicans or is it one of these other species? Like how, how much? When you have a yeast infection, it's not like they will. Necessarily culture or do they always

EAU2: Not necessarily that's the problem. You don't necessarily have to culture to get the data on what species it is. Uh, like where I work, we do PCRs and we, we can then strain type it and

EW2: Right. But you always do strain type and species type or that's what

EAU2: yeah, the PCR, that at least where I work, and this is not everywhere, but where I work, I swab everyone if I'm worried. Uh, try not to treat empirically. Lots of people will just get empiric treatment. Um, and the PCR test that we do checks for multiple different strains, so it's able to, and multiple different species. So it's able to tell us what that species is, which also will give us a hint as to whether it's more likely to be resistant, for example. If you're talking about an invasive infection in a hospital setting, yes, you're going to be culturing that or you're going to be doing something to figure out exactly what species we're talking about. But for a lot of mucocutaneous infections, people might be treated just empirically, meaning just based on clinical exam, which I'll be honest, it's usually pretty obvious, but not always. Um, and the reason I always swab is 'cause a lot of times you've got BV and yeast overgrowth, like it's not only just a one thing, um, but a lot of people will be treated empirically either because they don't have access to something like PCR or they can't afford it because it might be, you know, cost prohibitive. Um, or a lot like what we would do where I worked during residency is put it under a microscope and look at it under the swab. You know, look at it, look at the swab under the microscope, and then you can see the hyphal growth. But I don't know what species that

EW2: Mm-hmm. Mm-hmm.

EAU2: So then you're at least knowing for sure that it's a yeast infection and not a yeast plus other things, but then you don't necessarily know what species it is. So it totally just depends where you are and what the healthcare infrastructure is like. And so we don't know, to answer your question of is it just C? It's probably mostly still C albicans on the rise, but it's contributed by all of these other species as well, and by the increasing antifungal resistance that we see.

EW2: Mm-hmm.

EAU2: Um, especially in these other species of Candida, which again are on the rises in a lot of cases. And so that is a very real and very. Scary aspect of candida right now is just the rise in antifungal resistance, especially when it comes to C. auris. Something like 13 to 35% of isolates are found to be resistant to essentially all the antifungals that we have.

EW2: just detected this 16 years ago.

EAU2: Correct.

EW2: That

EAU2: math.

EW2: Very scary.

EAU2: I know, um, there's a lot of need, obviously for research in better, more accurate and faster diagnostic tools and better treatment options. There are some that are like being fast-tracked and you know, we're trying, there is actually a new drug approved for, I believe it's approved for recurrent vulvovaginal Candidiasis, um, that just got approved a couple of years ago. it reduces adverse reactions compared to Fluconazole. Um, but it doesn't necessarily help with azole resistance. Another thing that's commonly used for vulvovaginal infections is boric acid, uh, boric acid, like vaginal suppositories. Um. It's quite effective. It's like a broad spectrum antimicrobial and it generally is pretty safe and well tolerated, but it's not like approved for use by the FDA. It's also not commonly used in Canada or the eu, so it's actually really hard to get access to, like you have to go through a compounding pharmacy or you have to make your own suppositories. I don't really understand why like, I guess nobody, no pharmaceutical company has bothered to try and make a profit off of it. Is that the answer? I don't know.

EW2: Uh, yeah, maybe it's like in public domain or whatever, like

EAU2: Right. But I You mean like, why can't you just get a suppository? I don't

EW2: I feel like I remember, and I'm probably going to like completely butcher this recollection 'cause my memory is not good. Uh, but in, so the last season I did a book club episode on Vagina Obscura with Rachel Gross. She's amazing. And in her book she talks about using. A vaginal microbiome transplant, kinda like fecal transplants. Um, for, but I don't know if it was to treat recurrent yeast infections or like a really persistent bv. Um, but anyway, I loved that idea.

EAU2: I love all of the ideas that are looking more at our microbiome and our microbial communities and how they interact, because we know that that's such a big driver of these kinds of overgrowth, infections, opportunistic infections. So I don't know a lot about that, but it's really interesting to look

EW2: And I feel like we were, I was a little bit like down on probiotics or like, that's maybe the impression that I gave and I'm, I'm not like, I think there's a lot of potential. I just don't think we're at the stage where we can say, this will do this.

EAU2: no, and we're definitely not at the stage of saying, put yogurt in your vagina. This is not a medical advice podcast.

EW2: No,

EAU2: There is though also, um, people are working on a vaccine for recurrent vaginal candidiasis specifically. Um, it's an interesting type of vaccine 'cause it is based on like a candida protein of some kind. Um, but the idea at least who they're. Targeting right now, like who, who they're testing it on is people who've had recurrent infections. So it's kind of like to reduce the risk of recurrence rather than just like, uh, something to give to the whole population or something like that. Um, but. Yeah, it's really promising. I think the last paper that I saw on it, which might have been a year or two old now, um, they were in stage two trials, so I don't know if they've moved further from that. And then there's also a new type of antifungal that was recently approved and the reason for invasive infections. And the reason that's exciting is because it's a easier to administer. You don't have to do it daily. You can do it once weekly, um, and you can kind of front load it, which means because the other thing, and I didn't even get into this 'cause there's so many components you could talk about. When it comes to invasive candidiasis, these systemic infections, the long-term sequelae of them can be really severe. And there's not enough research into the quality of life, um, effects that we see after a systemic infection. They're really substantial. You know, if it gets into the eye, it can cause permanent blindness. People tend to be really sick before they even get a fungal infection. And so then the recovery from that, like from a prolonged hospitalization or ICU stay is really substantial. Um, so the fact that people are working on trying to make treatment so that it could potentially be done more in the outpatient setting is really, really huge and important. So there's a lot more that you can read about. When we tell you about our sources,

EW2: sources time. Okay. Okay. Let's see. Uh, I have several, a bunch, but I'm gonna shout out two in particular. So one is a book titled Fungal Disease in

Britain and the United States, 1850 to 2000 by Aya Homei and Michael Worboys. And then there was, oh, if you're interested in reading like a paper about this Nystatin relationship and like the anti. The hypersensitivity Candidiasis hypersensitivity syndrome. There was a paper from 1990 published in, I feel like it was the New England Journal of Medicine, uh, that studied the administration of Nystatin and whether it relieved any symptoms and like anything like that. And it's called, it's by Dismukes, uh, a randomized double-blind trial of Nystatin therapy.

EAU2: Love it. I had a number of papers for this. One of my favorites just for like, uh, overview of Candida was, uh, nature Reviews disease primers from 2024 called Invasive Candidiasis. Um, I also loved a couple of papers I had about the like, uh, virulence, but my favorite I think was from the journal Virulence, who knew, uh, in 2022 titled Pathogenesis and Virulence of Candida Albicans. And then I have several on the introduction and emergence of some of these other, uh, species of candida and what used to be candida. Um, and then the paper, uh, that was really great on. Recurrent Vulvovaginal Candidiasis was called Global Burden of Recurrent Vulva Vaginal Candidiasis. A Systemic Review in The Lancet Infectious Diseases from 2018, but I've got more, and you can find all of them on our website. This podcast will kill you.com under the episodes tab.

EW2: You certainly can. A big thank you again to the provider of our firsthand account. It really means so much to, for us and other people to hear your story. We appreciate it.

EAU2: Yeah, thank you. Thank you.

EW2: Thank you also to Blood Mobile for providing the music for this episode and all of our episodes.

EAU2: And thank you to Lianna and Tom and Brent and Pete and Jessica and everyone else at exactly Right network for helping make this podcast and the video- did you know we're on YouTube- possible.

EW2: And a big thank you to our listeners, our patrons. Your support means the world to us. Like we, we do this for you and it means so much that you actually tune in and hear what we have to say.

EAU2: Thank you

EW2: Thank you. Well, until next time, wash your hands.

EAU2: you filthy animals.