Homelessness and *Bartonella quintana* Infections

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[Candice Hoffmann] Welcome to the *Emerging Infectious Diseases* podcast. I'm Candice Hoffmann. In this episode we'll be discussing *Bartonella quintana* infections among persons experiencing homelessness. The December 2024 issue of EID has three articles on this topic. Two of the articles discuss organ-donor derived infections, and another discusses *Bartonella quintana* endocarditis. We'll hear from two of the authors of these articles.

[Grace Marx] I'm Dr. Grace Marx. I'm an infectious disease physician and still see patients regularly, but my primary work is as a medical epidemiologist with CDC's Division of Vector-Borne Diseases here in Fort Collins, Colorado. And one of the pathogens that we're responsible for is *Bartonella*. And we'll be talking about *Bartonella quintana* with you today.

[Emily Mosites] Hi, I'm Dr. Emily Mosites. I am an epidemiologist. I previously worked on homelessness and health at CDC and now I'm at a local health department in Oregon. I started working on homelessness after I responded to an outbreak of invasive group B strep among people experiencing homelessness in Alaska. And in the course of responding to that outbreak, I found some needs to develop resources for public health professionals so we could be empowered to find ways to address homelessness. And so that's how I started working on this topic at CDC headquarters. And now I'm on the local level.

[Candice Hoffmann] The pathogen, *Bartonella quintana,* has been around for a long time, though it hasn't always been known by that name.

[Grace Marx] *Bartonella quintana* is a bacterium that's transmitted by body lice. And studies have shown that *Bartonella quintana* has probably been around for millennia, maybe at least 4,000 years. But it's most well-known because it infected over a million World War I soldiers who often spent months in the deplorable conditions of trench warfare without access to running water. And this created an environment where body lice infestation was really common. And because of that, the disease that was caused by *Bartonella quintana* was commonly referred to as trench fever, which is this acute disease marked by relapsing fevers. But today, *Bartonella quintana* infection is known to cause diverse clinical manifestations. It can cause especially severe disease among people who are immunocompromised. And back in the 1990s*, Bartonella quintana* was identified as a major cause of bacillary angiomatosis, which is a vascular lesion of the skin or sometimes of the bone, and that affected many people living with AIDS. It can also cause bacillary peliosis hepatis, which is an involvement of the liver.

So *Bartonella quintana* can cause really prolonged bacteremia, which is infection of the bloodstream. And this is often subclinical or even completely asymptomatic. And this prolonged period of bacteremia is a risk factor for endocarditis, which is an infection of the heart. And this is today the primary manifestation of *Bartonella quintana* infection, often culture negative. And treatment is quite involved. It requires multiple months of treatment with antibiotics and very often surgical replacement of the infected heart valves for definitive treatment.

[Candice Hoffmann] *Bartonella quintana* is spread by body lice. It's important to note that body lice are NOT the same thing as head lice.

[Grace Marx] I feel like this always comes up when we talk about lice. Head lice are much more common than body lice. And I would say the primary difference between body lice and head lice is really where they live. So, body lice don't live on humans. Instead, they live on clothes, especially kind of at those seams of clothing that are close to the body. And this is really different from head lice that live directly on humans, usually in the hair. Both body lice and head lice are ectoparasites and they feed on human blood and their bite is incredibly itchy. And so, people with body lice often have severe itching and rashes where the body lice are biting them. Again, typically near those clothing seams. One of the other primary differences between body lice and head lice is that head lice aren't thought to transmit pathogens of concern. So, when we're talking about *Bartonella quintana*, it really is about body lice and the risk of transmission of disease.

And because body lice live on clothing, prevention and treatment is pretty simple. So, it really comes down to bathing and laundering clothing and also bedding at least once a week in hot water. And that will effectively kill both body lice and their eggs. And when I say hot water, that's about 130 degrees Fahrenheit. And as Dr. Mosites was saying, people experiencing homeless may not have regular access to hot water.

[Candice Hoffmann] *Bartonella quintana* infections can be treated with antibiotics. In severe cases, more intense treatment is needed.

[Grace Marx] There are several different types of antibiotics that are effective. The standard of care is typically doxycycline, although macrolides such as azithromycin are also effective. With severe disease, including endocarditis, you're really looking at prolonged treatment, often in combination with another antimicrobial, perhaps rifampin, which would be preferred. Aminoglycosides are also effective. And so, you're looking at kind of months of treatment for someone with severe disease. And then if there is involvement of the heart valves with endocarditis, typically you are talking about surgical removal of those heart valves with a replacement. And again, that's major surgery.

[Candice Hoffmann] Although at first glance, preventing and treating *Bartonella quintana* infections may seem simple since body lice can be stopped with hot water and infections can be treated with antibiotics, it is not that simple for everyone. In the United States, infections from louseborne *Bartonella quintana* almost exclusively occur among people who are experiencing homelessness. Dr. Mosites explained why homelessness increases the risk of *Bartonella quintana* and other infectious diseases.

[Emily Mosites] The risk for infectious diseases pretty much across the board, inclusive of *Bartonella quintana,* is much higher for people experiencing homelessness than for people who are housed. Kind of straightforwardly, if we just talk about the physical context of homelessness, if you picture yourself not having housing—think about where you're going to be, where you're going to sleep, where you might get food, where you go to the bathroom—meeting those basic needs is just, it's completely different. Like the patterns are completely different than if you're housed. And then that type of situation changes the way you prioritize your needs. And you might be thinking about where you're going to get breakfast that day. You might be thinking about where you're going to find a shower. Are those two things in different places totally across town from each other? Which of those is more important to be able to get through the day? One might be at a crowded shelter. One might be at a public restroom. So, there's this physical context of how you might meet those daily needs. And all of that comes together to create an entry point for risk. These alternating contexts of not being able to access services and then being crowded situations, it's a perfect storm for louse transmission.

[Candice Hoffmann] Body lice infestation is the main way people get infected with *Bartonella quintana*. If someone who has this infection is an organ donor, the infection can pass to organ recipients. One of the papers in the December 2024 issue of EID describes an investigation of two cases of *Bartonella quintana* infection in people who had received kidney transplants.

[Grace Marx] We described two patients who acquired *Bartonella quintana* infection after receiving transplanted kidneys from a single deceased organ donor. So, in this case, the infection was initially discovered in one of the transplant recipients, which really triggered this major investigation. And that involved trying to understand more about the organ donor and also trying to track down anyone else who might have received an organ from the same organ donor to see if there were other transmission events that occurred. So, the organ donor's medical history, medical records did not include history of homelessness, but part of this really extensive investigation included interviews with people who knew the organ donor while they were alive. And that did ultimately reveal this history of unsheltered homelessness in the months before their terminal hospitalization. And then we also coordinated with the relevant public health authorities and organ procurement organization to identify a second patient who had received the other kidney and were able to communicate with their clinicians and recommend testing for *Bartonella quintana*.

[Candice Hoffmann] The second kidney recipient was mostly asymptomatic, aside from joint pain that may or may not have been related to the infection.

[Grace Marx] We recommended testing anyway, and molecular testing with PCR of the whole blood was positive. So again, I think this investigation demonstrates a couple of important points. One is that housing status again needs to be routinely collected so that organ transplant clinicians are aware of a potential risk for *Bartonella quintana* if an organ donor was experiencing homelessness. And second, I also really want to emphasize that organs are lifesaving, right? So, you know, even if a risk is identified for *Bartonella quintana* infection, even if it's confirmed, we would not ever say that transplantation should not occur or that it should be delayed. Because as I said before, *Bartonella quintana* is a bacterium. It can be

effectively treated with one or more antibiotics. And I'm really happy to report that both cases here of these two kidney organ recipients who contracted *Bartonella quintana* as a result of the transplantation were adequately treated and are doing well.

[Candice Hoffmann] The cases reported in that article are part of a bigger picture. The perspective article, "Homelessness and Organ Donor–Derived *Bartonella quintana* Infection" discusses growing concerns about these infections. In the article, the authors made several calls to action, including disclosing organ donors' housing situations. Dr. Marx also stressed the importance of access to housing and hot water.

[Grace Marx] So, we do know that laundry is really important to prevent body lice, as important as showers and maybe even more so. It's challenging to implement those policy changes, as you might imagine, and it really comes down to resources, which vary widely, jurisdiction from jurisdiction. But we know it's effective. And so more than anything, getting people housed is, I would say, the top priority for all the reasons we've been discussing. But in cases where that's not possible, creating some type of consistent access to showers and laundry with hot water is really important to prevent these types of infectious diseases that can be very severe and even fatal.

[Candice Hoffmann] Dr. Mosites discussed how homeless service organizations can play an important role in prevention.

[Emily Mosites] I can start with this one and talk about the calls to action for homeless service organizations. These calls to action are focused around creating environments where the services needed to prevent lice and prevent the infection are pretty straightforward to access. So, I mentioned that the ability for someone experiencing homelessness, the ability for them to meet their needs is disrupted. And these calls to action are for homeless service organizations to help make the connections easier. So, making sure showers and laundry are available on site at shelter service sites, easy to access, have open hours long enough that people can get to them, those sorts of things. Making sure that donated clothes are not going to be a source of transmission, so, laundering those. And then when people do get sick, making sure that they can access healthcare, so that they can get treated quickly.

[Candice Hoffmann] Dr. Marx recommends that clinicians ask patients about their housing status, as a method to ensure swift *Bartonella quintana* infection diagnosis and as a way to provide further health and wellness support to vulnerable individuals.

[Grace Marx] I want to emphasize this point that it's really important for clinicians to ask their patients about housing status. So, if, you know, if a clinician knows that their patient is experiencing homelessness, that will inform their differential diagnosis about risk for certain infections, including *Bartonella quintana*. But in addition, it can also help them to understand that that patient need, may need help to be linked to services, including housing. And then for patients with a history of homelessness, it's important for clinicians to ask if they have itchy skin, do they have an itchy rash? And also, to perform a physical exam to look for a rash. For patients who say they have an itchy rash, clinicians can ask permission to look at their clothing and a close inspection of clothing seams, especially around the collar, around the waistline, pant legs, can identify body lice and their eggs. I do want to say clinicians should use contact precautions,

including gloves and gown, when examining patients with possible lice infestation to limit risk of infection transmission. And for patients with body lice infestation, the next step, of course, is to coordinate access to a hot shower, a clean change of clothing, and that can effectively disrupt that infestation.

I also want to take a minute to talk about diagnosis of *Bartonella quintana* because that's I think a really important element here too for clinicians to keep in mind. It's reasonable to test specifically for *Bartonella quintana* in patients with current or prior history of body lice infestation or for patients who have a history of homelessness or housing insecurity who may have symptoms consistent with *Bartonella quintana* infection. And there are a number of different diagnostic testing options for *Bartonella quintana,* and these include blood culture, serology, and also molecular diagnostic methods. Because *Bartonella quintana* is so slow growing and fastidious, bacterial cultures are often negative. So, if you're concerned about *Bartonella quintana*, you really do need to just call your micro lab and say, "look, I'm worried about *Bartonella quintana*." And that will prompt the lab to take certain steps to optimize conditions for growth. And that includes incubating for a prolonged period of time. So, rather than the typical five to seven days, you're talking about incubation periods of at least two weeks and ideally up to four weeks. And then they'll also again be able to set up that incubation under specific conditions that are optimal for *Bartonella quintana* growth.

Serology is still probably the most available diagnostic test, but it's really limited. Its sensitivity isn't great and it's not very specific because it cross reacts with many other *Bartonella* species. And so, when you get that test result back, it can be challenging to interpret. The optimal diagnostic method is really through molecular assays, and this includes species-specific PCR, which is offered at some commercial labs or broad-range 16S sequencing. And you can send whole blood for PCR or tissue. And this is fairly common, particularly in the context of endocarditis, when people are going into surgery for a heart valve replacement. And then we also know that microbial cell-free DNA testing of plasma is very effective at detecting even low levels of *Bartonella quintana*. And then of course, as a reminder, after a patient is diagnosed with this infection, they should always be treated, even if they're asymptomatic. And that's because, you know, this prolonged period of bacteremia can be a setup for end-organ damage, including endocarditis. And that treatment should always be done with an infectious disease physician, ideally with social worker support as necessary to facilitate completion of therapy, which can take weeks, even months.

And maybe finally, just a note about organ donor organizations, because as you say, in this paper, we demonstrated that transmission can occur via organ donation. And this kind of goes back to knowing about housing status. So, I think the recommendation fundamentally is that all organ donors and their next of kin in the setting of deceased organ donors should be asked about housing status. And that information should then be shared with clinicians of those transplant recipient patients to be aware of this possibility of elevated risk of *Bartonella quintana* infection if there is a history of housing insecurity. And that again kind of goes into clinician decision-making about testing, screening, and possibly even prophylaxis if it's known that the organ donor was experiencing homelessness.

[Candice Hoffmann] With *Bartonella quintana* infections, delays in diagnosis are unfortunately common.

[Grace Marx] This is one of the primary reasons for delayed diagnosis. I think first of all, clinicians aren't very familiar with this disease. So, you know, for patients to be appropriately tested, the clinician needs to be aware of this infection and be sending the correct diagnostic test for it. But then as I described, there's even the concern about delays in receiving that result. So, as I mentioned, bacterial culture can take weeks to detect *Bartonella quintana* at sufficient levels for detection. Serology, you might get back fairly quickly, but again, you're left with kind of questions about interpretation. I think molecular diagnosis is really where clinicians should be going because you can get results back fairly quickly typically, and then that will again facilitate getting that patient into treatment quickly.

[Candice Hoffmann] For people experiencing homelessness, there are also many challenges when it comes to accessing healthcare in the first place, as Dr. Mosites points out.

[Emily Mosites] I think what the paper shows clearly is you can see in the paper how the delays in diagnosis occurred, but what we can't see there inherently is the delays in access to care because there aren't touch points to record those delays. So, we don't see the front end where people experiencing homelessness aren't able to or don't want to access care for various reasons, one being the fragmentation of locations that I mentioned for services—those affect your ability to physically get to healthcare or proactively get an appointment. But also, those social and structural barriers, the stigma from healthcare systems. Your interest in seeking out healthcare might be very low. And that also continues into the treatment and recovery in this situation which can be really difficult.

I think it's actually a really big opportunity for public health and health care to help someone along their way towards stable housing if they do get this touch point with people who need treatment, someone needs to be treated, and they need to recover from an infectious disease like *Bartonella quintana.* That's an entry point for getting them connected into short-term housing where they can complete that treatment, where they can get connected into longer-term housing. So, we have this ability to walk with someone in their pathway towards housing at that touch point that we have with them.

[Grace Marx] And maybe I'll just add one other element here, and I think this hopefully illustrates the point that Dr. Mosites is mentioning about the implications of stigma. And even when patients might be able to access care, for example, with culture-negative endocarditis, that context of homelessness might make some clinicians less willing to provide definitive curative options. So, undergoing heart surgery for a valve replacement is a big deal. And you know, surgeons are very understandably concerned about outcome statistics and wanting to make sure that, you know, everything is optimized for a successful surgery. But someone who might be experiencing homelessness, someone who might have an active substance use may be…may have less access to definitive treatment with surgery that would be able to physically eradicate that infection by removing that heart valve that's infected. And so that's an ongoing issue as well within the healthcare system, even after someone is able to access care.

[Candice Hoffmann] As Dr. Marx mentioned earlier, *Bartonella quintana* can lead to severe infections like endocarditis, particularly when there is a delay in diagnosis. One of the papers in the December 2024 issue of EID describes five cases of culture-negative *Bartonella quintana* endocarditis that occurred in people experiencing homelessness.

[Grace Marx] Endocarditis is an infection of the heart, typically of the heart valves. And one of the primary ways that clinicians diagnose endocarditis is they send blood cultures. So, they'll take blood samples, usually two or more, and incubate it to see what grows. And the challenge with *Bartonella quintana* is that it is super slow growing. So, in a typical hospital laboratory, these blood cultures will remain in incubation for maybe five days, maybe seven days. And then if there's no growth, if no bacteria are detectable by then, they'll just throw it out. But the issue with *Bartonella quintana*, as I said, is very slow growing. And so, you got to keep incubating these blood cultures for at least two weeks and ideally up to four weeks before you're going to be able to see any bacterial growth to detect and to identify. So, the most common clinical manifestation for *Bartonella quintana* infection is culture-negative endocarditis. And so, when you have a patient…when clinicians have a patient with culture negative endocarditis, now one of the standards of care is to test specifically for *Bartonella*. And ideally that is using one of these molecular assays such as PCR or 16S sequencing or even microbial cell-free DNA testing. And that will be able to identify the species to enable specific and targeted treatment.

[Candice Hoffmann] The articles in the December 2024 issue of EID are part of a continuing effort to improve detection and prevention of *Bartonella quintana*, as Dr. Marx and Dr. Mosites explained.

[Grace Marx] So one of the things that we're really keen to do, and Dr. Mosites touched on this a little bit, is to think about whether we might be able to facilitate developing a standardized way to collect information about these infections. So, one thing that we're doing is we are in the process of developing a standardized case definition for *Bartonella quintana* infection with the hopes that that will encourage jurisdictions to consistently and regularly collect information on these infections. And this in turn will help us understand more about the frequency of this infection, also disease burden, with the goal of implementing targeted prevention and awareness campaigns among affected populations.

[Emily Mosites] Yeah, I would say, I mean, this set of articles is just really important. It highlights this very severe disease, and it's directly connected to lacking housing. And it shows how critical housing is for health. So really just beyond further research, there's work to do on these calls to action, work to do to help people get into housing and see where we each have a role in facilitating that.

[Candice Hoffmann] Dr. Marx described some of the efforts in place to raise awareness among clinicians.

[Grace Marx] I think one of the main things that we've learned is that clinicians really aren't familiar with *Bartonella quintana*. And so, we recently developed an online Medscape curriculum on bartonellosis, which includes modules specifically about *Bartonella quintana* prevention, diagnosis and treatment. So, I would encourage clinicians to look for that and take

that, which does offer CE. And we're also in the process of developing a number of other materials, including a slide deck about *Bartonella quintana* and body lice. It's kind of a train-the-trainer presentation. And we're hoping to share that tool with jurisdictions across the U.S. in hopes that they'll be able to provide education with professionals that work with this population, including staff at homeless shelters and also medical care providers who might have patients who are experiencing homelessness.

[Candice Hoffmann] Dr. Marx and Dr. Mosites have this advice for future researchers who might be interested in *Bartonella quintana*.

[Grace Marx] You know, I think *Bartonella quintana* is a neglected disease. It's a neglected disease right in front of our face here in the United States. You know, we see people experiencing homelessness every day and we don't know how often this infection occurs. And I would just encourage curiosity, especially for researchers, for clinicians, you know, we don't know how often this infection happens, even though we have all the tools to prevent it, to treat it, to diagnose it. So again, I think looking at the patients in front of us and having a curiosity that's informed by knowledge about risk of disease and how we might be able to help the people that we live with.

[Emily Mosites] I would say that my recommendation for people moving into these types of areas of work is to be comfortable with complexity and with gray areas and with recognizing that there are balances and nuances that we have to be able to nimbly navigate because something like homelessness, it causes these vast increases in risks for infectious diseases, but it is very complicated. And the ways that we can provide solutions that help alleviate some of that risk are not as straightforward as solving other problems and being okay with that and still continuing to move forward, even in the face of that complexity.

[Candice Hoffmann] Thanks for listening. We hope you have enjoyed listening to this podcast. We hope you are, or you will become, a regular reader of EID like Dr. Marx and Dr. Mosites.

[Grace Marx] I will say that EID is easily one of my favorite journals, just because it isn't kind of niche. It really is any emerging infectious disease, both in the U.S., outside of the U.S. The diversity of articles is really commendable. And I always find it interesting to see what's being highlighted every month and enjoy the podcast as well. So, thanks again for creating this opportunity for us today.

[Emily Mosites] I can answer and say yes, because we had an amazing supplement come out with you guys. I have loved working with you guys and love the stuff that you come up with. As soon as these articles came out, someone at my health department was like, what is this? And was really excited about them and sent them my way. So, really appreciate you guys.

[Candice Hoffmann] Thanks for listening to our podcast. You can read the *Emerging Infectious Diseases* journal at cdc.gov/eid. You can also follow EID on X and Instagram @eidjournal, and on LinkedIn @eid-journal.

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