Good afternoon. I am Commander Ibad Khan, and I'm representing the Clinician Outreach and Communication Activity, COCA, with the Emergency Risk Communication Branch at the Centers for Disease Control and Prevention. I would like to welcome you to today's COCA Call, Lyme Disease Updates and New Educational Tools for Clinicians. All participants joining us today are in listen only mode.

Free continuing education is offered for this webinar. Instructions on how to earn continuing education will be provided at the end of the call. In compliance with continuing education requirements, CDC, our planners, our presenters, and their spouses/ partners wish to disclose they have no financial interests or other relationships with the manufacturers of commercial products, suppliers of commercial services, or commercial supporters. Planners have reviewed content to ensure there is no bias. This presentation will not include any discussion of the unlabeled use of a product or a product under investigation of use. CDC did not accept commercial support for this continuing education activity.

At the conclusion of today's session, the participants will be able to accomplish the following: describe populations at risk of contracting Lyme disease in the United States, describe early signs and symptoms of Lyme disease, identify the appropriate use of diagnostic tests for Lyme disease, cite the appropriate use of antibiotics to treat Lyme disease, and effectively promote clinician and patient education and early signs and symptoms of Lyme disease, tick bite prevention, and postexposure prophylaxis.

After the presentation, there will be a Q&A session. You may submit questions at any time during today's presentation. To ask a question using Zoom, click the Q&A button at the bottom of your screen and then type a question in the Q&A box. Please note, we receive many more questions than we can answer during our webinars.

If you are a patient, please refer your questions to your healthcare provider. If you are a member of the media, please contact CDC Media Relations at 404-639-3286, or send an e-mail to media@cdc.gov. It is my pleasure to welcome our presenter for today's COCA Call. We are pleased to have with us Lieutenant Commander Grace Marx.

Lieutenant Commander Marx is a medical epidemiologist with the Bacterial Diseases Branch in the CDC's Division of Vector-borne Diseases where she conducts epidemiological research on Lyme disease and the prevention of tick bites and tick-borne diseases. Lieutenant Commander Marx has developed numerous educational and reference materials for healthcare providers related to the treatment, management, and prevention of Lyme disease, an online data dashboard of emergency department visits for tick bites, and she has co-authored and authored many Lyme disease publications. I would like to turn over to Lieutenant Commander Marx. Lieutenant Commander Marx, please proceed.

Hi, thank you. My name is Grace Marx, as was mentioned. As many of you know, May is Lyme disease with awareness month. I'm particularly happy to be presenting updates about Lyme disease on today's COCA Call. I will also be highlighting several new educational tools for clinicians that I hope will be useful to you and your practice. Next slide.

For this webinar, I have five primary objectives, which are to describe populations at risk of contracting Lyme disease in the U.S., to describe early signs and symptoms of Lyme disease, to identify appropriate use of diagnostic tests and antibiotic treatment for Lyme disease, and finally to promote clinician and patient education of Lyme disease, tick bite prevention, and postexposure prophylaxis. Much of the content that I will be presenting today are highlights from a free online, four module, clinician training series on Lyme disease that we will be releasing in the next few weeks on CDC TRAIN. Next slide.

To start, I will provide some relevant background on Lyme disease as well as describe populations at most risk for this tickborne disease. Next slide. Lyme disease is caused by a bacterial infection with certain Borrelia species. In the U.S., essentially, all cases are due to infection with Borrelia burgdorferi. These bacteria are spirochetes, which are motile and spiral shaped. Next slide. Transmission of these spirochetes can occur after the bite of a tick infected with Borrelia spirochetes.

An infected tick has to be attached to a person for at least 24 hours before transmission can occur, and most transmission occurs after 36 hours of attachment. Next slide. This graph shows the most common reported tickborne diseases in 2018. The most recent year for which national data are currently available. As you can see, Lyme disease is by far the most common reported tickborne disease in the U.S. Next slide.

Alarmingly, the number of reported cases of Lyme disease more than doubled from 1998-2018, and the number remains high year after year. As you can see in this graph, which shows numbers of reported cases by year, approximately 30-40,000 cases of Lyme disease have been reported to CDC in recent years. However, it is likely that the actual number of people infected each year is much higher than the number of reported cases.

In fact, CDC estimates that approximately 500,000 people are diagnosed and treated for Lyme disease annually. Next slide. Most cases of Lyme disease occur in the summer months of June and July, shortly after the season when ticks are most active and when people are typically outdoors and more likely to be exposed to ticks. However, as you can see in this chart, cases of Lyme disease are reported year-round. Next Slide.

Geographically, Lyme disease is a highly focal disease, and infections are highly concentrated heavily in the northeastern, mid-Atlantic, and upper Midwestern states. Cases reported from other regions are usually associated with travel to states with higher rates of infection. Exceptions occur along the West Coast in Northern California, Oregon, and Washington where infected Western black legged ticks caused some cases of Lyme disease each year. As shown in this map, at this time, 95% cases are from 15 states and Washington DC, but the disease continues to spread from these endemic foci to neighboring states. Next slide.

Ticks do not jump, fly, or drop from above. A tick that is questing, or waiting for a host, rests on the tops of grasses and shrubs and can attach when a person brushes directly against it, usually when someone is outdoors working or recreating. The tick then attaches itself and slowly becomes engorged with blood as it feeds. Next slide.

In the U.S., the only ticks that transmit the pathogens that cause Lyme disease are Ixodes ticks. Ixodes ticks are extremely small and teardrop shaped. The image of a dime here helps show just how tiny these ticks are. The black-legged tick nymph is responsible for most Lyme disease cases and is about the size of a poppy seed. Next slide.

Tick bites are very common. In a recent MMWR published just last month, we reported that about 150,000 emergency department visits for tick bite were identified during a three year period, with an incidence of 49 visits for tick bite per 100,000 ED visits. Next slide. The new CDC Tick Bite Data Tracker is a public facing dashboard that shows ED tick bite visit data by patient age, sex, region, and season.

The dashboard is updated weekly and users can filter the data by region and year. On the left, you can see the seasonal trend of tick bite ED visits, with 2021 data shown by the solid blue line and the average incidence of tick bite visits during 2017-2019 shown as a comparison by the red dotted line. On the right, you can see the regions by which data can be stratified. Check out the tick bite data tracker to see the current trend in ED tick bite visits in your area by visiting the URL at the bottom of the slide. Next slide.

Given how often patients present for care after a tick bite, it is important for clinicians to know how to manage and counsel patients after a tick bite. In this section, we will review what to do when patients present following a known or suspected tick bite and how to determine if a patient might benefit from Lyme disease postexposure prophylaxis. Next slide.

CDC has a useful one-page clinician resource that summarizes recommendations for the clinical care of patients after a tick bite, including information on tick removal, Lyme disease prophylaxis, and symptoms of tickborne disease to watch for. A link to the downloadable PDF is shown here at the bottom of the slide. Next slide.

To prevent pathogen transmission, the most important thing to do is to safely remove an attached tick as soon as possible. Teaching patients proper removal will enable them to remove ticks quickly at home without waiting to see a medical professional. To remove an attached tick, use fine tipped tweezers to grasp the tick as close as possible to the skin's surface. Next slide.

Then pull upward with steady, even pressure. Do not twist or jerk the tick. Patients should also be counseled not to cover, burn, or squish an attached tick. Next slide.

After the tick is completely removed, the area and hands should be thoroughly cleaned. Next slide.

Because most tick bites do not transmit disease, antimicrobial postexposure prophylaxis for Lyme disease prevention is not routinely recommended for tick bites. However, PEP can be appropriate after high-risk tick bites. It is important to know that PEP has only been shown to be effective for Lyme disease prevention and is not recommended to prevent other tickborne diseases. Next slide.

To determine if PEP is appropriate for a patient, a provider should consider the following questions. First, in the region where the tick bite occurred, are ticks likely to be infected with Borrelia burgdorferi? Second, was the tick removed within the last 72 hours? Third, was the tick's body flat or was it engorged with blood? Fourth, was the tick an Ixodes or a blacklegged tick? And finally, is doxycycline safe for the patient? Next slide.

We put these questions into a clinical decision-making aid to help clinicians walk through these questions to determine if PEP to prevent Lyme disease might be beneficial. You can go through this in detail on your own, but the takeaway point is that PEP most likely to be beneficial when it's given to patients after a higher risk tick bite by a black leg tick shortly after removal. Next slide.

For adults, the dose for Lyme disease postexposure prophylaxis is a single dose of 200 milligrams of oral Doxycycline. For children about 45 kilogram or 100 pounds, PEP is a single dose of 4.4 milligrams of oral Doxycycline per kilogram, with a maximum dose of 200 milligrams. Next slide.

It is important to note that short courses of doxycycline are safe to use in children of all ages. In 2018, the American Academy of Pediatrics or AAP updated their recommendation to liberalize the use of Doxycycline for all ages of children after conducting a comprehensive review of the data which showed no association between two sustaining or 21 days of Doxycycline. Next slide.

Whether you prescribe PEP or not, advise any patient who presents with a known or suspected tick bite to watch for symptoms that might suggest a tickborne disease such as fever, rash, or malaise. If any of these symptoms emerge over the month following the bite, the patient should return for evaluation immediately. Remember that an asymptomatic patient might be in the incubation period for a tickborne disease when they first present for care, and they might develop symptoms in the next few days to weeks. Next slide.

A common question from both healthcare providers and patients is, should removed ticks be tested for pathogens? CDC does not recommend this practice as a diagnostic tool for tickborne diseases. In other words, tick testing results should not be used as a proxy for tickborne disease testing in patients. Testing ticks for pathogens can lead patients and healthcare providers to make decisions about antibiotic treatment without conclusive evidence of patient infection, which could lead to unnecessary antibiotics. Next slide.

People who have one tick bite are likely at high risk of being bitten again. When a patient presents for care after a tick bite, always take the opportunity to provide counseling about how to prevent future tick bites. Effective ways to prevent tick bites include the use of EPA registered insect repellents, performing daily tick checks, bathing within a couple hours after coming indoors, and putting clothes in the dryer on high heat to kill any ticks that might be on the clothing. Avoiding tick habitat, preventing tick bites in pets, and finally reducing tick habitat in your yard. Next slide.

Currently, a vaccine to prevent Lyme disease is not available. As you may know, there was a vaccine available between 1998 and 2002. That vaccine, called LYMERix, was shown to be both

safe and effective, but it was pulled from the market in 2002. New vaccines are in development that may become available in the future. Keep in mind that once a vaccine is available, it will only be effective against Lyme disease, thus tick bite prevention strategies, like those mentioned, will still be essential for protection against those other tickborne diseases. Next slide.

Lyme disease can affect multiple organ systems and early recognition and treatment is important. Next slide.

When early, localized Lyme disease is not recognized and treated, Spirochetemia may occur, resulting in early disseminated disease and then progressing to late disseminated disease. Next slide.

This graphic shows the typical manifestations that can occur at each stage of disease. The timeline begins at the left of the graphic. When a person is infected with the bacterium that causes Lyme disease after the bite of an infected tick. Early localized Lyme disease usually presenting as a single Erythema Migrans (EM) rash occurs within one month of a tick bite. Erythema Migrans is often accompanied by nonspecific symptoms similar to a viral syndrome. Next slide.

Early disseminated disease typically occurs 1-3 months after the tick bite. Patients with early disseminated Lyme disease can have various manifestations, including multiple Erythema Migrans rash, facial palsy or other cranial neuropathies, meningitis, and carditis which typically presents as heart block. Next slide.

Arthritis is the hallmark manifestation of late disseminated Lyme disease and typically occurs three months or more after the tick bite. Over half of patients with untreated Erythema Migrans go on to have Lyme arthritis. Next slide.

This figure shows the frequency of disease manifestation for Lyme disease cases with clinical information reported to CDC between 2008 and 2018. Keep in mind that this does not include data from cases that were not reported to CDC. As you can see here, erythema migrans occurs in 70% of Lyme disease cases reported to CDC, which is likely an underestimate, because cases of patients with severe symptoms or later manifestations are more likely to be reported to public health and might be overrepresented. Because of this, the percentages of later manifestations such as arthritis may be higher than what is seen in the real world. Next slide.

The Erythema Migrans rash, or EM rash, has an incubation period of 3-30 days with an average of 7-14 days after a tick bite. Next slide. Up to half of all people diagnosed with Lyme disease don't recall being bitten by a tick. Patients who present with EM rash are not always aware of a tick bite, especially when the bite occurs in hard to see areas like the back of the knee or on the scalp. Next slide.

The EM rash is typically a round, erythematous patch that can be warm to the touch. It is rarely painful or itchy. The rash usually expands slowly over multiple days and typically reaches a size greater than 5 centimeters in diameter and may be as large as 30 centimeters in diameter.

Central clearing can occur as the rash enlarges, resulting in what is known as a bull's-eye. Patients who are seen early in the development of the rash are less likely to have a rash with a bull's-eye appearance. The picture shown here is a classic example of an EM lesion, but they can have other appearances such as a triangular or asymmetric shape, have a bluish hue, or be without central clearing. Next slide.

Correct diagnosis of EM in a patient of color requires careful examination. Erythema migrans in people with darker skin tones can present as a darker lesion that is typically circular and can have central clearing. Next slide. As mentioned, when early localized disease is not recognized or treated, spirochetemia can occur, resulting in disseminated disease. Manifestations of disseminated Lyme disease can take varying forms, including dermatologic manifestations such as multiple EM rashes; neurologic manifestations such as facial palsy, radiculoneuritos, and lymphocytic meningitis; cardiac manifestations such as carditis; and muscular skeletal manifestations such as arthritis. Next slide.

Lyme disease reinfection is possible. This is a particular concern for people living in areas where Lyme disease is common, where they may be at increased risk simply by spending time in their own backyard. For these reasons, it is important to talk about prevention at the time of initial diagnosis and to explain that being diagnosed with Lyme disease might suggest behaviors that increase risk of being exposed to future tick bites, which could lead to reinfection. Next slide. Healthcare providers also sometimes wonder about whether patients can be infected with both Lyme disease and another tickborne disease.

Co-infections do sometimes occur. The tick that transmits the spirochetes that causes Lyme disease can transmit several other pathogens, including those that cause Anaplasmosis, Babesiosis, Ehrlichiosis, Borrelia miyaotoi disease, Borrelia mayonii disease, and Powassan virus disease. Risk of tickborne co-infection is geographically localized. If you were concerned that your patient might have a co-infection, talk to your local public health department to learn about the risk in your area. The most common co-infections that occur with Lyme disease are Anaplasmosis and Babesiosis. Next slide.

When patients with Lyme disease present with unusual or more severe symptoms or signs, it can be helpful to test for co-infection. These symptoms can include high fever or gastrointestinal complaints like nausea, vomiting, and abdominal pain. Laboratory abnormalities including hemolysis such as anemia, elevated LDH, or elevated indirect bilirubin might suggest babesiosis. Different medications may be needed because antibiotics from Lyme disease do not treat babesiosis. Specific cytopenias including neutropenia, leukopenia, and thrombocytopenia might suggest anaplasmosis. Next slide, I will review Lyme disease diagnosis and testing. Next slide.

CDC recommends that healthcare providers use diagnostic tests for Lyme disease that have been evaluated and cleared by the Food and Drug Administration or the FDA. Currently, the only FDA cleared tests for Lyme disease are two-step serologic tests.

This two-step approach is designed to increase accuracy of a Lyme disease diagnosis. Recently, APHL or the Association of Public Health Laboratories published suggested lab reporting and provider interpretation for Lyme disease serologic test results. This can be a great reference for

both clinicians and patients to help accurately interpret Lyme disease two-step serologic test results. Next slide. This flowchart shows how to interpret two-step Lyme disease serologic tests, moving from left to right in the schematic, you can see that samples should first be tested by enzymes immunoassay (EIA) or another test cleared by the FDA as a first test.

If this first test is positive or equivocal, it should be followed by a confirmatory second test. The second test can be a Western blot assay or another test cleared by the FDA as a second test. Both steps can be performed using the same serum sample. Most labs are set up so that if the first step test is positive, the lab will automatically reflects to perform the second step test. Only when the second test is also positive or equivocal is the overall test result considered positive.

Two-step Lyme disease serology has a very high sensitivity and specificity for patients with disseminated or late-stage disease. Thus, if two-step testing is negative in a patient with symptoms disseminated or late Lyme disease, the clinician should consider alternate diagnoses. Next slide.

The Western blot for Lyme disease tests for two different types of antibodies, IgM and IgG. On the left is a Western blot IgM, and on the right is a Western blot IgG.

In each shown here, the first lane on the left is a positive control. Individual bands that are useful for the diagnosis of Lyme disease are shown by the numbered arrowheads. On the second lane on the right in each Western blot are results from a patient that tested positive for Lyme disease. A positive IgM Western blot requires at least two out of three specific bands while a positive IgG Western blot requires at least five out of 10 specific bands. Next slide.

The IgG Western blot is more reliable than the IgM Western blot, but IgM antibodies develop sooner and so can be helpful to detect earlier disease. Because of this, IgM Western blot results should only be considered during the first month of symptoms. Next slide. In July of 2019, the FDA cleared four new tests that use a second specific EIA in place of the Western immuoblot assay. The new modified protocol replaces the Western blot second step test with the option to use another specific test cleared by the FDA. Currently, these are all EIA tests and are made by certain manufacturers. Next slide.

The two EIAs in the modified two-step serology protocol can be conducted either sequentially or simultaneously. Compared with the Western blot assay, the EIA has several advantages as the second step test, including greater objectivity of test result interpretation and lower burden on lab personnel, because the process is less time intensive. Next slide.

Lyme disease is not always easy to diagnose. Laboratory tests can aid with diagnosis, but like other screening tests, there's a risk of false negative and false positive results, both of which can complicate or postpone accurate diagnosis and treatment. When Lyme disease is on the differential diagnosis for a patient, clinicians should ask themselves two questions prior to testing. First, what is the pretest probability of this patient having Lyme disease? And second, what is the disease stage? Next slide.

Pretest probability is defined as the likelihood of disease before test results are known. In other words, how likely is it that a particular patient has Lyme disease? There are three clinical questions that can help make this determination. First, has the patient been in an area where Lyme disease is common? Second, was the patient likely exposed to ticks? And third, does the patient have symptoms that are characteristic of Lyme disease? If the answer to any of these questions is no, the patient has a low pretest probability of having Lyme disease. If the answer to all three questions is yes, pretest probability is moderate to high. Next slide.

When pretest probability is low, which would be the case if the patient has not been in an area where Lyme disease is common, had no possible exposure to ticks, or is asymptomatic or has nonspecific symptoms that are not characteristic of Lyme disease, testing is not advised. Next slide.

But why is testing not advised in the setting of low pretest probability? Low pretest probability increases the risk of false positive test results and can lead to misdiagnosis. Misdiagnosis can result in unnecessary treatment and patient anxiety as well as failing to treat the true cause of illness. Next slide.

For patients with a moderate to high pretest probability, which would be the case for patients who have been in an area where Lyme disease is common, were likely exposed to ticks, and have symptoms characteristic of Lyme disease, diagnostic testing can be very helpful. However, the disease stage needs to be considered, because disease stage strongly affects sensitivity of serologic testing. Next slide.

This table shows the sensitivity of serologic tests for Lyme disease. It shows that it is dependent on the disease stage. Serologic testing relies on the detection of antibodies, which take time to develop after initial infection.

Low test sensitivity during early stages of a disease is due to the lack of antibodies during the seroconversion window period. The bottom line is that serologic testing is most clinically helpful when patients have symptoms of disseminated Lyme disease. For a patient who presents with single erythema migrans, the rash of early localized Lyme disease, the diagnosis is clinical, and the patient should be treated empirically without doing any diagnostic testing, which will likely just be negative because antibodies have not yet had time to develop. Next slide.

The seroconversion window period is the time from infection to the time when antibodies can be detected in a serologic test. The window period for Lyme disease for IgM is typically around two weeks and about three weeks for IgG. As mentioned at the beginning of this webinar, the typical incubation period for erythema migrans or EM rash is one to two weeks, so it's very common for a patient with an EM rash to be in the seroconversion window period at the time of presentation and test negative for Lyme disease by two-step serologic testing. Next slide.

Clinicians and patients often wonder about whether a patient can be tested to monitor treatment efficacy or to verify that a patient has been cured of Lyme disease. Unfortunately, the answer is no.

Serial Lyme disease serology tests for a patient who has previously tested positive to monitor or establish adequate response to treatment is not clinically helpful as antibody levels can remain elevated for years after the infection has been cured. Next slide.

In the last section of this webinar, I will review the clinical management and treatment of Lyme disease. Next slide.

Lyme disease can be treated effectively with antibiotics. Antibiotic regimens may differ, depending on Lyme disease manifestation. Recommended antibiotic durations range from 10 days to four weeks. Most patients have complete resolution of illness following treatment. However, sequelae are possible especially when patients are diagnosed and treated at later stages of disease. For this reason recognizing, diagnosing, and providing timely treatment for Lyme disease is essential. Next slide.

The recommended treatment for Erythema migrans is the same whether for a single lesion, typical of early localized Lyme disease or multiple EM rashes, which is a sign of early disseminated disease. The antibiotics and the duration of treatment for EM rash are the same for adults and children of all ages. Doxycycline for 10-14 days or amoxicillin or cefuroxime for 14 days. For children, the dose is based on their weight. Next slide.

As mentioned previously, the American Academy of Pediatrics approves the use of short courses of doxycycline in children of all ages, including in children in less than eight years of age. Previously, doxycycline was contraindicated in children under the age of eight for fear of permanent tooth staining due to the effects in the related antibiotic tetracycline. However, more recent studies have shown no tooth staining or other adverse effects on young children with short courses of doxycycline in 21 days or less. Next slide.

This chart summarizes the treatment for neurologic Lyme disease. As you can see at the top of the chart, Lyme disease facial palsy in both adults and children should be treated with oral doxycycline. More severe manifestations of neurologic Lyme disease such as meningitis or radiculoneuritis can be treated with either doxycycline or intravenous ceftriaxone. For patients started on intravenous ceftriaxone, oral doxycycline can be substituted when the patient is stabilized or discharged to complete the antibiotic course. Duration of treatment for neurologic Lyme disease is two to three weeks. Next slide.

Lyme carditis can be rapidly fatal if not treated promptly. As a result, suspected Lyme carditis is a medical emergency and patients should receive immediate care and treatment. Due to the potentially life-threatening nature of this condition, do not wait for Lyme serology results prior to starting antibiotics. Next slide.

Treatment for Lyme carditis varies based on the severity of the disease. Mild cases of Lyme carditis can be treated with oral antibiotics. However, patients with severe Lyme carditis should be hospitalized, monitored with cardiac telemetry, and treated with intravenous antibiotics. Severe Lyme carditis includes patients who are symptomatic, have first-degree AV block with PR prolongation over 300 milliseconds, or have second or third-degree AV block. Total treatment duration for mild and severe Lyme carditis should be two to three weeks. Next slide.

Lastly, this table summarizes treatment for an initial episode of Lyme arthritis. The antibiotic options are still doxycycline, amoxicillin, or cefuroxime, but the recommended duration of treatment is longer, 28 days. Due to the duration of treatment, it is recommended that patients under eight years of age be prescribed amoxicillin or cefuroxine rather than doxycycline because of limited safety data for use of doxycycline for more than 21 days in children under the age of eight years. Next slide.

While most patients with Lyme arthritis will have symptom improvement after treatment, some patients experience persistent joint inflammation. If joint pain or swelling persists after completion of a four-week antibiotic course, patients should return to the clinic for evaluation. A second course of antibiotics can be considered for patients with Lyme arthritis who have an incomplete response after the first course of antibiotics. Next slide.

Factors to consider when selecting which antibiotic to prescribe for a patient with Lyme disease include dosing, side effects, and allergy profile. Doxycycline has the advantage of being a slightly shorter treatment regimen for Erythema migrans and also being an effective treatment for several other tickborne diseases including anaplasmosis, ehrlichiosis, Rocky mountain spotted disease, and Borrelia miyamotoi. Next slide.

Prompt diagnosis and treatment are recommended for pregnant or breastfeeding patients with Lyme disease. Doxycycline use by pregnant or breastfeeding women has not been thoroughly studied. However, amoxicillin, cefuroxime, and azithromycin are all generally considered safe for use by patients who are breastfeeding or pregnant. Next slide.

I would like to close by talking about post treatment considerations. It is important to know that most patients with Lyme disease recover completely within weeks to months after a course of antibiotic treatment. Next slide.

However, some patients will take longer to feel completely well. About one in every 20 patients treated for Lyme disease experience symptoms such as pain, fatigue, or difficulty thinking that lasts for more than six months after finishing treatment. Next slide.

Unfortunately, there is no proven treatment for these post treatment symptoms. The National Institutes of Health have found that additional prolonged antibiotic treatment has not been shown to improve long-term patient outcomes compared to patients who receive placebo. In fact, long-term antibiotic therapy has the potential for serious side effects, including infectious diarrhea, antibiotic resistance, and Lyme associated infections or clots. As a result, more than two courses of antibiotics are not recommended for the treatment of Lyme disease. Next slide.

Sometimes a patient may present for evaluation after having already received a diagnosis of Lyme disease and who are on treatment that is not recommended for Lyme disease. For patients presenting for care who are on treatment not recommended for Lyme disease, take the time to listen to them. Ask about their diagnostic history and their treatment course. Always perform a thorough physical exam. Together review the potential risks and benefits of treatment and explain about any potential adverse effects of treatments that are not recommended for Lyme disease. Evaluate their risk for Lyme disease and consider alternate diagnoses. The goal is to

demonstrate empathy and compassion while emphasizing that the goal is to manage symptoms and to improve quality of life and ability to function. Next slide.

To close, I would like to again highlight several of the new CDC tools for clinicians about Lyme disease. Next slide.

First, we have developed a comprehensive free online clinician training course on Lyme disease that offers four credits of continuing education. These modules go into greater depth and are built around specific patient case series that describe the various manifestations of Lyme disease and provide additional support for clinicians who care for patients with suspected Lyme disease. These modules are expected to go live sometime in the next few weeks and will be available on CDC TRAIN.

I am also listing here are a few other links to other resources that are also available online. As always, please let us know what other resources would be available to you as you evaluate, diagnose, and treat patients with Lyme disease in your practice. Next slide.

Thank you for your attention, and I would be happy to take any questions.

Thank you, Lieutenant Commander Marx for providing our audience with such timely information.

We will now go to the Q&A session. Please remember to ask a question using Zoom. Click the Q&A button at the bottom of your screen and type your question.

Our first question asks, what options do I have for PEP if the patient cannot be administered doxycycline?

It is a very good question and unfortunately one without a great answer. Most of the data for a single dose of doxycycline for PEP come out from a single study done a number of years ago looking at a single dose of doxycycline. There have been other studies that have been done as well looking at use of amoxicillin, penicillin, cefuroxine, sometimes for longer periods, not just a single dose. However, those mostly were underpowered and were not conclusive. The recommendation is really to only use doxycycline for postexposure prophylaxis after a high-risk tick bite.

Thank you for that. The next question asks, during the first portion of your presentation, you talked about reducing thick habitat around your home in the backyard, for instance. Can you perhaps share some steps on things that should be undertaken to make a household or yard less habitable to ticks?

Yes, absolutely. Ticks really like living in areas that have a lot of vegetation, it might be shady, the ticks that transmit the pathogen that causes Lyme disease don't typically like a short grass out in the open sun. Keeping the grass cut short with regular mowing is a good way to reduce tick habitat. Also, clearing a lot of leaf litter that might be collecting especially in the fall months would be good, and then just thinking about where you spend time in the yard and trying to keep

away from those areas with thick vegetation. For example, if you have a young child with a playground in the backyard, you might want to make sure that you pull that to the center of the lawn where there is a lot of kind of open short grass around that immediate vicinity. Again, to reduce the risk of someone coming in contact with ticks in the backyard.

Thank you so much for that. The next question asks, how long is the EM rash generally present for?

It's a good question. We do not have a lot of recent information about kind of the natural history of Lyme disease because, of course, most Lyme disease is treated quickly after it is recognized. And then the rash can disappear fairly shortly after antibiotics are initiated. As was mentioned, you will typically have the single EM rash that will form and kind of enlarge over a number of days, lasting potentially several weeks. That will just disappear over time, even if it is not treated.

But then as spirochetemia occurs as that bacteria disseminates through the body, you can have other manifestations, including multiple EM rashes. Typically, those look pretty similar to that single EM rash but there is more than one of them. They tend to be smaller than a single EM rash and when you see that, it is important to note that that doesn't represent multiple tick bites, it just represents dissemination of that disease. Again, treating as soon as possible, whether it single or multiple EM rashes is very important.

Thank you very much. A follow-up question slightly related. Is it okay for me to test for Lyme disease greater than 14 days after rash onset if the patient was treated with doxycycline at rash presentation?

Yes, as mentioned, it does take some time for antibodies to develop. That kind of period in which we would expect results to be negative are two to three weeks. If you wait and test later, you might see the results become positive.

One thing that I did not cover in the webinar due to time constraints is that one option is to go ahead and test when someone presents with an EM rash. Again, that's most likely negative. Then have the patient come back in a month and test again. If you see a positive test result after four weeks, which was negative before, you can be pretty sure that the patient did have Lyme disease. Again, I would not wait for those results to come in before testing. Testing of erythema migrans really should be an empirical not a clinical call not based on the results of diagnostic testing.

Thank you very much. Our next question asks, are we seeing increasing incidence of Lyme disease due to climate change?

So that question does come up fairly frequently. We certainly do see more Lyme disease as I mentioned at the outset of the webinar almost every year. you see numbers going up. It's probably due to a number of different factors.

Climate change potentially being one of them, but we are seeing range expansion of the tick and an increasing abundance of ticks in general. Again, there's probably many reasons for why it's

happening, but at least in part it's almost certainly due to reforestation that has been pretty extensive in the Northeast, mid-Atlantic, and upper Midwest, which are those areas where we see a lot of Lyme disease. The other thing is that controlling ticks is difficult. We don't really have a great way to control ticks that have been shown to reduce Lyme disease incidence at the population level. You can use acaricides and spray outside, but when studies have been done to see if the reduction in ticks as a result of exposure to the acaricides results to a reduction in Lyme disease incidents, we have not seen that bear out to be true.

Again, we do not have a lot of methods at our disposal to control ticks in our environment. And then the last point I just want to make is that diagnostics have continued to improve. There is also greater recognition of the problem of Lyme disease by both healthcare providers but also by patients. With this increased awareness of Lyme disease and tickborne diseases in general, more tests are being done, and there are more cases as a result of being diagnosed and treated each year.

Thank you for that. Are you also aware of any data of Lyme disease cases increasing in other countries as well?

Yeah. So there is limited data here. Lyme disease is definitely a big problem in Europe, and we do see very high numbers of Lyme disease each year. Different countries have different methods for surveillance of Lyme disease, and it is not a reportable disease across the EU, so we do not have a lot of great data about changes in incidence from year-to-year, but we do know that incidence is very high, similar to what we see here in the United States.

Thank you very much. And we have time for one last question and sort of like a two-part question, I suppose. The first part asks, is Lyme disease the only tickborne disease increasing, or are you seeing an increase in all tickborne diseases? The second part is, should I test my patient for other tickborne diseases when I test for Lyme disease?

Yeah. To address the first question about other tickborne diseases, there are a number of other tickborne diseases where incidence is on the rise. I would namely callout anaplasmosis where we have seen very large increase in the last few years. Again, anaplasmosis is transmitted by the same tick that transmits borrelia burgdorferi, that causes Lyme disease. That is perhaps not entirely surprising.

There is also new tickborne diseases that we are identifying each year, and we have a number of ongoing efforts at CDC in collaboration with academic institutions, public health agencies across the country to identify new tickborne diseases. Certainly, we have seen a number of them recently identified, including viruses, not only bacterial tickborne diseases.

To address the second part of the question, should I test my patient for other tickborne diseases after I test for Lyme disease? Again, I mentioned that co-infections are certainly possible. Again, not surprising because the same black-legged tick can transmit more than one pathogen. But when you are thinking about testing a patient for any tickborne disease, it's important to be guided by a thorough understanding of the epidemiology of that disease as well as by patient symptoms.

As I mentioned, specific ticks species are capable of transmitting different human diseases. If you happen to know what species of tick bit your patient, if they happen to come in with a little plastic baggie with that tick, that can be helpful to narrow down the differential diagnosis potentially. Also, specific tickborne diseases can have unique symptoms which can differentiate between diseases and guide your decision as a clinician about which diseases are more likely and again to prioritize testing. I would also strongly recommend checking out we have this great resource that we have put together called Ticks and Tickborne Diseases which is a manual for clinicians, and it's beautifully illustrated and walks through the different ticks so it helps with tick identification, but it also walks through all the tickborne the diseases in the United States and describes their symptomology as well as the recommended treatment that you can access online. You can also reach out to us and we can send a copy in the mail. That could be a potentially great resource for you as well in your practice.

Thank you very much. I want to thank everyone for joining us today with a special thanks to our presenter, Lieutenant Commander Grace Marx. Thank you for your time. All continuing education for COCA Calls are issued online through the CDC Training and Continuing Education Online System at https://tceols.cdc.gov.

Those who participate in today's call and wish to receive continuing education, please complete the online evaluation by June 21, 2021, with the course code WC2922-052021. The access code is COCA052021. Those who will participate in the on demand onlie activity hand wish to receive continuing education should complete the online education between June 22, 2021, and June 22, 2023, and use course code WD2922-052021. The access code is COCA052021.

Continuing education certificates can be printed immediately upon completion of your online evaluation. A cumulative transcript of all CDC ADSR continuing education obtained through the CDC Training and Continuing Education Online system will be maintained for each user. Today's COCA Call will be available to view on-demand a few hours after this live call. You can find the video recording of today's call at emergency.cdc.gov/coca. Again, that is emergency.cdc.gov/coca. Join us for two upcoming COCA Calls where free continuing education will be offered.

The next scheduled COCA call, Underlying Medical Conditions and Severe COVID-19: Evidence-based Information for Healthcare Providers, will be held one week from today on Thursday, May 27.

Then the following week on Thursday, June 3, we will hold another COVID-19 related COCA Call where the topic will be Evaluating and Caring for Patients with Suspected Long COVID. Both of these calls will be at 2:00 PM Eastern time.

More information and call announcements will be available soon. Please share these call announcements with your clinical colleagues. Also, you can sign-up to receive weekly COVID-19 science updates by visiting the link offered here. Again, these links can also be found on emergency.cdc.gov/coca.

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