Good afternoon, everyone. I'm Captain Ibad Khan and I'm representing the Clinician Outreach and Communication Activity, COCA, with the Office of Emergency Risk Communication at the Centers for Disease Control and Prevention. I'd like to welcome you to today's COCA Call: What Clinicians Need to Know about Dengue in the United States.

All participants joining us today are in listen-only mode.

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At the conclusion of today's session, participants will be able to accomplish the following. Summarize dengue epidemiology and transmission in the United States. List the clinical features of dengue. Explain dengue diagnostic testing for patients with suspected dengue. And describe appropriate treatments for dengue patients according to severity classification.

After today's presentations, there will be a Q&A session. You may submit questions at any time during today's presentation via the Microsoft Teams platform. Please note that the ability to ask a question during the live webinar is limited by Microsoft to the first 1,000

attendees who join the webinar. If you are unable to ask a question during the webinar, you may submit your question after the live session by emailing coca@cdc.gov.

Kindly note that 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 and have a question, please contact CDC Media Relations at www.cdc. gov/media. Click Contact Media Relations at the bottom of the page and complete the Request for Comment form.

I would now like to welcome our presenters for today's COCA Call. We are very pleased to have with us Dr. Laura Adams, an epidemiologist, and Dr. Liliana Sanchez-Gonzalez, who's a medical epidemiologist, both from the Dengue Branch in the Division of Vector-Borne Diseases at the National Center for Emerging and Zoonotic Infectious Diseases at the Centers for Disease Control and Prevention.

It is my pleasure now to turn it over to Dr. Adams. Dr. Adams, please proceed.

Thank you very much. Today, we're going to be talking about what clinicians need to know about dengue in the United States. Next slide.

We'll be starting with some background on dengue and then get into a bit about the current situation currently in the U.S. Next slide.

We'll start with a quick overview of dengue basics. Next slide.

Dengue is caused by infection with any one of four distinct dengue viruses. Infection with one dengue virus provides lifelong immunity to that specific virus, but only short-term cross-protective immunity against other dengue viruses. This means individuals can potentially be infected multiple times. Next slide.

Dengue virus transmission most commonly occurs through the bite of an infected mosquito. *Aedes aegypti* is the most common vector, shown on the top right. However, *Aedes albopictus*, shown on the bottom, can also sustain transmission. Other modes of transmission for dengue virus are much less common, but include perinatal transmission from a mother to a baby, through breast milk, blood transfusion or organ transplantation, a needle stick or other hospital or laboratory accident, and rarely sexual transmission. Next slide.

Aedes mosquitoes lay their eggs on the inner walls of water-holding containers, like tires, pots, and buckets shown in the images below, and are common in urban areas. Next slide.

Dengue virus transmission occurs when a person who is acutely infected with dengue virus gets bitten by a mosquito. During the extrinsic incubation period, the virus replicates in the

mosquito for 8 to 12 days before the mosquito can transmit dengue virus to another person. After the infected mosquito bites another person, there's an intrinsic incubation period of around 3 to 14 days before symptoms develop. Next slide.

Among people who are infected with dengue virus, about 60 to 80 percent will have asymptomatic or subclinical infections. Of the 20 to 40 percent who are symptomatic, around 1 to 5 percent will progress to severe dengue. And among those with severe dengue, most will survive, but up to 5% can be fatal. Next slide.

Multiple factors can affect an individual's risk for severe dengue. There's a known risk by age, with higher risk among infants born to seropositive mothers, as well as elderly populations.

Underlying comorbidities can also be associated with worse outcomes, including asthma, diabetes, obesity, hypertension, and the other factors listed on the slide.

Pregnancy has also been associated with a higher risk for progression to severe dengue.

Finally, the number of dengue infections and the time between those infections can also play a role. Although severe dengue can occur during any dengue infection, there's a higher risk on the second dengue infection compared to the first, third, or fourth infection. Next slide.

For dengue prevention, recommendations include using EPA-registered insect repellents and wearing protective clothing like loose-fitting, long-sleeve shirts and pants. People can also take action to control mosquitoes indoors and outdoors. This includes cleaning or eliminating water-holding containers where mosquitoes can lay eggs, and using screens or air conditioning if possible. Next slide.

Dengue vaccines are becoming available globally, and three of them have completed phase three trials, which are shown here. However, none are currently available in the U.S. Dengvaxia was licensed in the U. S., but the manufacturer stopped production and all remaining doses expired earlier this year.

The TAK-003 vaccine and the TV003 vaccine have been licensed in other countries but are not licensed in the U. S. The number of doses required and ages eligible vary by vaccine.

Prevaccination screening was required for Dengvaxia, but has not been required for the other vaccines in the countries where they're licensed. And efficacy against virologically confirmed dengue for all three vaccines has varied based on serostatus or if the person has had dengue before or not, as well as by dengue virus serotype. Next slide.

Next, let's talk briefly about the current dengue situation. Next slide.

This figure shows dengue cases reported to the Pan American Health Organization from countries across the Americas, and you can see that dengue cases have increased steadily over the past 25 years. This is not a linear increase because this is mainly driven by outbreaks, which occur around every three to five years in endemic areas. This increase has also been driven by larger outbreaks in endemic areas, as well as increasing frequency of locally acquired cases in new areas. Next slide.

Dengue occurs in tropical and subtropical areas globally, as shown by this map of dengue cases reported to the World Health Organization so far this year. Next slide.

In U.S. states, dengue cases usually occur among travelers to endemic areas. This figure shows the number of travel-associated dengue cases reported to CDC from 2010 to 2025, with a peak in 2024 of more than 3, 700 cases driven by large outbreaks globally. Next slide.

This figure shows dengue cases among travelers this year, shown in the green bars, compared to the most recent five years, which are shown in the background lines.

First, you can see that there are clear seasonal trends, with higher case numbers among travelers usually occurring in the second-half of the year. For 2026 specifically, We've seen an increase in recent weeks, although these numbers are similar to the past few years, which as you saw in the previous slide, have been the highest years on record. Next slide.

Although dengue is not considered endemic in the continental U. S., competent dengue mosquito vectors are present in many U.S. states. The figure on the left shows the estimated range of *Aedes aegypti*, and the right shows the range of *Aedes albopictus*. Next slide.

We have seen sporadic locally acquired cases and small outbreaks occur in multiple U.S. states over the past 15 years. The highest number has been reported from Florida. We've also seen cases in recent years in Texas, California, and Arizona, as well as the first locally acquired case identified in Virginia earlier this year. Dengue is considered endemic in six U.S. territories and freely associated states. Next slide.

In late September of this year, an emergency was declared in three Florida counties due to local dengue transmission. These local cases included one death due to dengue. Next slide.

Locally acquired dengue cases in Florida have increased rapidly in 2026, shown here in the red line, with other high transmission years shown for context, and cases continue to be reported. This is the largest locally acquired dengue outbreak in Florida since the 1930s. Next slide.

In total, 288 travel associated dengue cases have been identified in Florida this year as of October 15. 368 locally acquired cases have been reported from 8 counties. The majority of these are in the Tampa Bay area, primarily from Hillsborough County. Twenty mosquito pools have also tested positive for dengue virus. Next slide.

Among the locally acquired dengue cases in Florida, the majority have been infected with dengue virus 2. Approximately half were male and the median age is 43 years. Although cases have been reported among all age groups, about 45% occurred among adults 30 to 49 years old. Nearly half of the cases, or 47%, required hospitalization. Next slide.

The summary points from this section are that dengue is a growing health threat globally. Dengue cases among travelers to the U.S. are increasing in recent weeks, and we've seen ongoing local transmission of dengue virus in multiple Florida counties. Public health partners can continue to encourage dengue prevention among people traveling to and living in areas with active dengue virus transmission. Next slide.

Thank you, and I'll turn it over to Dr. Sanchez-Gonzalez for the next section.

Thank you. Now we'll talk about dengue clinical features, the diagnostic testing approach, and management recommendations based on the patient's clinical presentation. Next slide.

Let's start with the clinical presentation. Next.

The most common initial presentation of dengue is characterized by a high fever, usually with abrupt onset. Fever is present in almost all patients with dengue, and it is commonly accompanied by aches and pains, including headache, retro-orbital pain, myalgia, and arthralgia.

Dengue is sometimes called breakbone fever, because these aches and pains can be intense and debilitating. Nausea and vomiting are also common, as is anorexia. Skin manifestations, including rash and petechia, are frequently reported, and about a third of patients may also have mild mucosal bleeding, such as epistaxis, gum bleeding, or hematuria. Other symptoms can include diarrhea, dysgeusia, lymphadenopathy, and conjunctival injection. Respiratory symptoms, including cough, runny nose, and sore throat, can occur, but they are much less common. Next slide.

We should suspect dengue in any patient who lives or has traveled to an area with dengue transmission within the last two weeks, who is febrile, and who presents with two of the criteria listed here. Nausea or vomiting, rash, aches and pains, a positive tourniquet test or petechia, and leukopenia. Any warning sign also counts as a clinical criterion, but we

review them in the next slides. Once we suspect dengue, we need to determine the patient's clinical severity classification. Next slide.

Patients who meet the clinical criteria listed here again and do not have warning signs are classified as having dengue or dengue without warning signs. Next slide.

We should assess warning signs in all patients with suspected or confirmed dengue, as they indicate a higher risk of progression to severe disease and require close monitoring. Warning signs include abdominal pain or [inaudible], persisting vomiting, including here is a suggested definition, fluid accumulation, such as ascites or pleural effusions, any mucosal bleeding, such as epistaxis, hematuria, or abnormal vaginal bleeding, altered mental status, commonly reported as lethargy, restlessness, or drowsiness, liver enlargement, or hemoconcentration, a progressive increase in hematocrit. Patients with one or more warning signs are classified as having dengue with warning signs. Next slide.

Patients are classified as having severe dengue if they have any severe manifestation. If they have severe plasma leakage, which is the hallmark of severe dengue that is leading to shock or respiratory distress, or if they have severe bleeding, or if there is severe organ involvement. The organs that can be mostly affected includes the liver with hepatitis, brain encephalitis, and heart myocarditis.

The clinical severity of dengue can change over time, and a patient who initially had dengue without warning signs can develop warning signs and can present with severe manifestations. Many times we will need to reclassify the clinical severity based on our clinical assessment. Next slide.

Let's now talk about the dengue clinical course. The incubation period after a mosquito bite can range from 3 to 14 days, as mentioned before, although it is usually short, about 3 to 5 days. After the incubation period, symptomatic dengue generally follows 3 clinical phases. Next slide.

The first phase is the febrile phase. This is when patients have the symptoms that we just reviewed, including fever that gives this phase its name. Fever and other symptoms usually last two to seven days, and this is when most symptomatic patients will seek medical care. Patients are viremic during this phase, and as you see here, they might also be viremic for a couple of days before symptoms begin. This means that a mosquito that bites them at this time can become infected and continue with the transmission cycle. Clinical problems during this phase include dehydration, electrolyte disturbances, and febrile seizures, especially in younger children. Next slide.

The defervescence, which is the abatement of fever, usually occurs between days 3 and 8 of illness. Most patients improve as the fever resolves. However, some patients enter the

critical phase that usually lasts one to two days and is when capillary permeability increases. This can lead to plasma leakage, which is the movement of fluid out of the blood vessels into the interstitial space.

Most warning signs are associated with plasma leakage and are commonly seen toward the end of the febrile phase or during the critical phase. Severe manifestations also can develop during this phase. Severe plasma leakage can result in shock, which is the most common severe manifestation. And recognizing the critical phase is key to monitoring and managing patients appropriately. Next slide.

The final phase is the recovery or convalescent phase that usually lasts about 3 to 5 days. During this phase, the fluid that moved into the tissues early is gradually reabsorbed. Potential clinical problems here include hypervolemia or pulmonary edema, and this can occur when patients receive excessive intravenous fluids, IV fluids, during earlier phases of illness. And this highlights why your tissues IV fluid administration is very important, especially in patients with relevant coexisting conditions.

So this, febrile, critical, and recovery are the three typical clinical phases of DENC. Next slide.

Rashes are very common in patients with dengue. With the abrupt onset of fever, patients may have marked flushing, redness of the face, neck, and chest, as shown in the first picture here. During the febrile phase, patients might develop a macular or maculopapular rash that often starts on the trunk and spreads to the face and limbs. Is usually blanchable, as shown in the last image here, and it might later become scaly. The first and the second images here show the same patient, because patients with dengue can have different rashes during different phases of the illness. Next slide.

During the recovery phase, patients can develop a characteristic confluent rash with areas of spared skin. It is commonly described as islands of white in a sea of red or Herman's rash. And this rash often desquamates and can be extremely itchy. In some patients, itching is the reason they seek medical care. The appearance of the rash can vary depending on the patient's skin complexion. And here you can see four different patients with the characteristic rash, their recovery phase. Next slide.

Let's pause here for a knowledge check. We have a 27-year-old woman who returned four days ago from a one-week trip to Puerto Rico. She has had four days of fever, headache, myalgia, and macular rash. Since yesterday, her fever has subsided with a maximum temperature of 37. 4. Today, she comes with abdominal pain and unexpected new onset heavy menstrual bleeding. Her vital signs are normal and she has no respiratory distress or signs of shock.

What is the most appropriate clinical severity classification for this patient?

Dengue without warning signs, dengue with warning signs, severe dengue, or this patient does not meet clinical criteria.

I'll give you a few seconds to consider the options. Next slide.

The correct answer is B, dengue with warning signs. This patient has abdominal pain, which is a warning sign, and she's also reported abnormal menstrual bleeding. Remember that any mucosal bleeding is a warning sign in dengue, and it is important to ask about bleeding that might not be obvious during the physical examination, including changes in the color of the urine or stools and changes in menstrual flow. Next slide.

Severe plasma leakage is the main pathophysiological process that can lead to severe dengue. So how do we recognize plasma leakage? The key sign is hemoconcentration. We identify this when the hematocrit is at least 20% above the patient's baseline, if you have a baseline available, or 20% above the normal expected value for the patient's sex and age. Hemoconcentration can be also recognized when the hematocrit drops by 20% or more after IV fluid administration, without evidence of bleeding that would explain this change. In this situation, the IV fluids may be diluting the hemoconcentration caused by plasma leakage. So it is very important that you obtain a complete blood count during the first assessment of a patient with suspected dengue that you can use as your baseline for monitoring.

Another important sign is clinical fluid accumulation, such as ascites or pleural effusion. Clinical assessment might identify fluid accumulation. Your patients may have respiratory distress, abdominal discomfort, or flank pain.

And imaging, including chest X-rays or abdominal ultrasounds, can help identify or confirm smaller amounts of fluid accumulation. Next slide.

Shock is the most common manifestation of severe dengue, and unrecognized shock continues to be a common cause of death among patients with dengue. It is therefore very important to look for early signs of shock, not only hypotension. One early sign of shock is a narrowing pulse pressure. This means that the difference between the systolic and diastolic blood pressure values is 20 or less. In patients with substantial plasma leakage, compensatory mechanisms can maintain adequate circulation for a while, increasing the diastolic pressure. And this narrows the difference between the two pressure values. If plasma leakage continues without adequate fluid replacement, then hypotension and shock can develop. Other signs of early shock include delayed capillary fill or evidence or other evidence of poor peripheral perfusion.

Tachycardia in the absence of fever is another important sign, particularly in children. Next slide. The most common laboratory findings in dengue are leukopenia, hemoconcentration, and thrombocytopenia.

During the febrile phase, in yellow, laboratory results may still be normal. Toward the end of the febrile phase and at the beginning of the critical phase, patients may develop leukopenia with neutropenia, the brown line here, and lymphocytosis, the black line. Hemoconcentration, here in blue, also develops around the beginning of the critical phase because plasma is leaving the intravascular space and is increasing the concentration of red blood cells. And the hematocrit usually begins to recover as the critical phase ends. Platelets, here in purple, may take longer to decrease, so a normal platelet count during the febrile phase does not rule out dengue. The lowest platelet count usually coincides with the highest hematocrit during the critical phase, and platelets might take longer to recover. Thrombocytopenia can persist well into the recovery phase. Next slide.

Other laboratory findings might include mild elevation in liver enzymes, AST and ALT, especially AST, even in non-severe cases. Hyponatremia, prolonged coagulation times, and low serum albumin related to plasma leakage can also be present. Depending on the patient's clinical severity, you can find other lab abnormalities, including metabolic acidosis, increased creatinine, elevated troponins, or elevated B-type natriuretic peptides.

Several biomarkers have been associated with progression to severe dengue, but they are not currently universally recommended biomarkers that reliable predict progression to severe disease. Next slide.

Dengue has a broad differential diagnosis that includes viral bacterial and parasitic infections, among other conditions. You can see here the most common. And as with other diseases, to determine the most relevant differential diagnosis, we should consider the patient's clinical presentation, exposure and travel history, and epidemiological trends. In areas with other hypoviruses such as chikungunya, Zika, and yellow fever circulate, they should be considered.

Febrile illnesses with rash, including measles and rubella, can also resemble dengue. During the first days of illness, respiratory viruses such as influenza or COVID-19 can present with symptoms that are very similar to those of dengue and clinical differentiation can be really challenging.

As the respiratory virus season begins in the U.S., it is important to consider the epidemiology and the seasonality of these pathogens to guide clinical suspicion and testing. Next slide.

The key messages from this section. Dengue is a dynamic disease. The clinical presentation can change quickly. Every time we evaluate a patient with dengue, we should look for warning signs and manifestations of severe dengue. These findings will guide clinical specification and management.

Plasma leakage and progression to severe dengue usually occur during the critical phase, and shock rather than bleeding is the most common severe manifestation. So early recognition and close monitoring of the critical phase, warning signs, and signs of shock is essential for patients with dengue. Next slide.

Now, let's talk about diagnostic testing. Next slide.

First, if you suspect dengue, clinical management should not be delayed while waiting for laboratory confirmation. Monitor and manage your patient as a patient with dengue. Next slide.

In the U.S., dengue is a nationally notifiable disease, so suspected or confirmed cases should be reported to your state or local health department. If needed, the arboviral surveillance teams can help you arrange diagnostic testing. Rapid tests are not widely available in the U.S., and none are FDA approved. And there are some private laboratories that can offer different options for dengue testing. Recommended testing approach depends on how many days have passed since symptom onset. Next slide.

Let's look at the figure on the left. Days of symptoms are on the x-axis and sensitivity of the test is on the y-axis. The yellow shade shows the typical longest duration of fever, 7 days, and this is the main window we have to detect viruses and confirm the diagnosis. Dengue NS1, or the non-structural protein one, is here in blue, is most detectable during the first 7 to 9 days of illness. Dengue viral RNA, here in purple, is detected mainly during the seven first days of illness. IgM antibody, shown in black, generally becomes detectable around day four and can remain detectable for up to 90 days.

So during the first seven days of illness, as shown on the right, we recommend ordering an RT-PCR test plus IgM test or an NS1 antigen test and an IgM test. These to increase the likelihood of confirming a dengue diagnosis. Next slide. After 7 days of illness, an IgM ELISA test is the primary recommended test.

You can still consider RT-PCR or NS1 antigen testing, especially if you have symptomatic patients, although sensitivity is lower than it is during the first seven days of illness. It is important to remember that if you order only an IgM test during the first few days of illness, the result might be negative, even when the patient has dengue, as you can see on the graph. And then there is cross reactivity with other flaviviruses, such as West Nile virus.

Positive IgM results that we get among local acquired cases might need additional testing for confirmation, such as plaue reduction neutralization. Next slide.

So let's apply this to the same patient. Remember, she has had four days of fever and other general symptoms. Her fever began to subside yesterday, and today she's presenting with warning signs.

What would be the most appropriate diagnostic approach for this patient?

We should not test because her fever has begun to subside. We should order an NS1 antigen testing because she's within the first seven days of illness. We order a dengue RT-PCR or NS1 test and a dengue IgM antibody test. And we only order IgM antibody testing because she's on day four already.

I'll give you a few seconds to consider the options here. Next slide.

The correct answer is C, order a dengue RT-PCR or NS1 test plus a dengue IgM antibody test. She's within the first seven days of illness, so testing should include a method that detects the virus or part of the virus along with IgM antibody. IgM alone could be negative early in the illness as here in day four, and testing should be ordered for all patients who suspected dengue, even if the fever has started to resolve. Next slide.

Let's now discuss clinical management. Next slide.

There are some antivirals, monoclonal antibodies, and other medications that have shown promising results in early clinical trials for the management of dengue. However, treatment of dengue remains largely supportive. Appropriate monitoring and IV fluid management can greatly reduce mortality among patients with dengue. And we assign patients to management groups A, B, or C based on clinical presentation for existing conditions and laboratory findings. The majority of patients can be managed at home.

And for those who require hospitalization, judicious IV fluid administration is the main tool we have to prevent poor clinical outcome. Next slide.

Oh, sorry, can you previous slide, please? I forgot to mention the CDC pocket guide that is shown here on the right was included in the resources for this call, and it provides a practical approach to classifying patients with dengue and following the management algorithms. Next slide, please.

Patients can be classified as group A and managed as outpatients when they have no warning signs, they can tolerate oral fluids, and they have a normal urine output. Most patients will meet criteria for this group, so most patients with dengue can be managed at

home. Ideally, these patients should be assessed every day with a complete blood count until they are out of the critical phase.

In practical terms, this means that we monitor these patients until 48 hours after the fever goes away or after defervescence. At each assessment, we look for signs of dehydration, defervescence, and warning signs. It is key that we provide clear instructions to the patients so that they know which warning signs require immediate medical attention and they can return.

In children, adequate oral fluid intake has been associated with lower rates of hospitalization. Abundant oral fluids should be encouraged in all patients with dengue.

Recent WHO guidelines published in 2025 reviewed a substantial body of evidence available, and they suggest they use a protocolized oral fluid treatment for patients with dengue. This means giving the patient a specific oral hydration plan to follow at home. They also suggest paracetamol for pain or fever, and they recommend against aspirin and NSAIDs because we are not certain they are safe for patients with dengue, and they could increase the risk of bleeding. Febrile patients should rest and sleep under a mosquito net. This helps prevent mosquitoes from biting the patient, becoming infected, and then continuing transmission. Next slide.

Patients are assigned to group B when they have warning signs. Any coexisting conditions that increase the risk of severe disease, including pregnancy, we recommend hospitalization of all pregnant women with dengue, or social circumstances that would prevent them from returning quickly to the hospital if needed. These patients should be placed under medical observation or hospitalized. We order baseline laboratory testing, placement of an IV line. Not all patients in this group will require IV fluids. Careful monitoring of intake and output. And if the oral fluid intake is inadequate, or the patient presents with warning signs, IV fluids should be administered according to the appropriate algorithm. We'll see more in the next slides.

Hematocrit should generally be monitored every four to six hours for these patients, but this will depend on the patient's condition, clinical presentation. Next slide.

There are several important principles for fluid management in patients with dengue. We limit IV fluids during the febrile phase.

IV fluids are usually only needed for 24 to 48 hours during the critical phase. We use isotonic solutions, and the goal is to give the minimum amount needed to restore intravascular volume, maintain good perfusion, and maintain good urine output. Most importantly, we reassess the patient after fluid administration changes and look for clinical

response. We monitor perfusion, urine output, and hematocrit. And we base the IV fluids rates on ideal body weight.

The 2025 WHO guidelines suggest the use of crystalloid fluids over colloids for all patients with dengue and recommend using capillary refill time and serum lactate in addition to standard clinical assessment to guide the IV fluid management. Next slide.

Patients with severe danger manifestations are assigned to Group C and require emergency treatment. This includes patients with shock, respiratory distress caused by severe plasma leakage, severe bleeding, or severe organ involvement. These patients require hospitalization, often in an intensive care unit. We order baseline lab testing, blood type and screen, oxygen support, and we manage them with IV fluid boluses 10 to 20 mL per kilogram. Hemodynamic status should be monitored continuously when possible, and hematocrits may be needed to be checked every one to four hours in this patient, depending on clinical presentation and response. Intake and output should be monitored closely, and because these patients receive large quantities of IV fluids, we must also monitor for signs of fluid overload, including tachypnea, increased liver size, and peripheral edema. Next slide, please.

In 2025, the Pan American Health Organization conducted a detailed review of evidence available and published a guideline with additional recommendations for the management of severe dengue, especially for patients in the intensive care unit.

Key from this guideline is a recommendation of considering the early use of vasoactive agents in patients with dengue and persistent hypotension. Norepinephrine for adults and epinephrine for children. And the use of serum lactate, capillary refill time, and point of care ultrasound to help guide fluid management. Next slide, please.

And here I wanted to show you what would be the management for our patient with dengue with warning signs that we discussed previously in the knowledge checks.

This is the algorithm in the CDC Pocket Guide for patients in group B. And with inside the blue lines, you can see that for this patient, we would obtain an initial complete blood count. In the second box, that we would administer crystalloid IV fluids at a rate of 10 mL per kilogram in one hour. The third box, we would reassess the patient for clinical response. Then on the right, if the patient does not respond, we can administer additional IV fluids at the same rate of 10 mL per kilogram. If the patient responds, on the left, you can see the box, we follow a stepwise decrease of the amount of IV fluids. We move to 5 to 7 mL per kilogram per hour for a couple of hours, then to 3 to 5 mL per kilogram per hour for another couple of hours, and so on.

We always reassess the clinical status of the patient with every change in the IV fluid rate. And as you can see, the IV fluid rate can go up and down several times during the management of a patient with dengue and requires frequent monitoring of clinical response. Managing IV fluids in a patient with dengue might require intensive human resources to continuously track clinical response and adjust the IV fluid rates. This is one of the reasons why dengue outbreaks can overwhelm health systems. So we know that this careful approach works and most patients respond to this dynamic IV fluid management. Next slide.

What we do not do with patients with dengue. We do not use corticosteroids routinely because there is no evidence that they provide any benefit in patients with dengue.

We do not use NSAIDs because we don't have evidence that they are safe in patients with dengue and they can increase the risk of bleeding.

We do not give intramuscular injections, because of the risk of bleeding.

We do not give prophylactic platelet transfusions as they are not beneficial in patients with dengue and they can increase the risk of adverse events. Next slide.

Before discharge, patients should meet several criteria.

They should have been without fever for at least 48 hours, indicating that they are out of the critical phase. They should have a stable hematocrit without IV fluids, indicating that there is no plasma leakage. They should show an increase in trend in platelet count. And here, please note that there is no specific recommended number, but rather an increase in trend in the serial measurements of platelets meets these criteria. And they should also have an overall improvement in clinical stats. Next slide.

So let's summarize the main messages in the second part of this call. First, we should suspect dengue in any fever at patient with an appropriate exposure within the previous 14 days.

Second, we should determine the patient's clinical severity, the phase of disease, and the risk factors for severe dengue.

Third, we should identify warning signs and early signs of shock, and remember that shock, rather than bleeding, is the most common severe manifestation.

Fourth, we are to order diagnostic testing based on the time since symptom onset. Within the first seven days, we used RT-PCR or NS1 together with IgM. Fifth, we classify patients into groups, group A, B, or C, based on their clinical findings, coexisting conditions, and laboratory findings. And finally, we use a stepwise approach to IV fluid management. We

give enough fluids to restore intravascular volume and to maintain good perfusion and urine output, and then we reassess frequently to adjust rates as necessary. Next slide.

For additional training, CDC offers a series of three interactive web-based modules on dengue. They are designed for clinicians, public health professionals, and health educators. They include clinical cases, and each activity offers free continuing education. We encourage you to complete these trainings. Next slide.

Thank you for your attention. We welcome your questions. You can also contact the CDC Dengue Team for questions at dengue@cdc.gov.

And I will now turn it over to Captain Khan.

Thank you. Presenters, thank you so much for providing this timely information to our audience. We will now go into our Q&A session. For our audience, you may submit questions via the Microsoft Teams platform.

Again, please note the ability to ask a question during the live webinar is limited by Microsoft to the first 1,000 attendees who joined the webinar.

Please keep your questions related to the clinical nature since our audience is supposed to be clinicians and healthcare providers. Those are the questions we'll be addressing.

And if you are unable to ask a question during the webinar or we're not able to get to your question, you may submit your question after the live session by emailing coca@cdc.gov.

So our first question for our presenters asks, would you consider acute kidney injury or end stage renal disease patients on dialysis to be in group B? And would you recommend hospitalization during their illness?

But can you hear me now?

Yes, we can hear you. I think, okay, sorry.

Yes, that's a good question. Yes, acute kidney injury, it is one of the criteria that we consider as a factor for increased risk to progression to severe disease, along with pregnancy, coagulopathies. The recommended we recommend hospitalization of these patients if they have suspected or confirmed dengue.

Yes, there are other for other coexisting conditions, high blood pressure, obesity, the others that Dr. Adams mentioned, we work with those patients on a case-by-case basis and we determine if the patient needs to be hospitalized. But for pregnant women, patients with acute kidney injury, and patients with coagulopathies or taking anticoagulant therapy, we recommend them to be hospitalized.

Thank you very much. Can you also differentiate while we're speaking about patient care like this, can you differentiate between indications for oral versus IV rehydration for patients with dengue?

Not sure if I understood the question. In general or for a specific group? For group B?

I think let's speak generally, but if it's more relevant to group B, then we can, if that's one of the criteria is to determine between oral and IV, I think that's what this question is trying to get at, if I was to just read between the lines.

Okay, yes, so intolerance to oral fluids is one of the criteria that we take to determine if a patient needs to be hospitalized. If there is no tolerance to oral fluids, that we would recommend the patient to be kept under observation because of the importance of hydration in patients with dengue. In many cases, we start IV fluid management and we continue to monitor tolerance to oral fluids and we start oral fluids as soon as possible because we know that it is. Because these. It increases that the [inaudible]. Sorry, I'm signing my oh, there. I don't know.

We recommend continue trying oral hydration in all patients with dengue as soon as possible, because it has a lot of benefits in these patients. So it is one of the criteria we use to determine if they should be kept in a hospital, but it's also one of the main interventions we have to improve patients with dengue.

Great, thank you so much. And along the same lines of assessment, we have a question that asks, what bedside findings can help clinicians recognize early shock before hypotension develops?

So I mentioned some of them. Narrow impulse pressure is very important. We should not wait until the patient has hypotension to consider this patient to be in shock. And narrow impulse pressure, the difference between the systolic and diastolic blood pressures being 20 or less indicates that the patient might be entering into shock. So that's a very important one. And we in patients with dengue always record their blood pressure and always record the pulse pressure. We also look for signs of peripheral low perfusion. So capillary refill time is very important to assess in patients with dengue, as well as, you know, if the extremities are warm, if we have [inaudible]. Any, any additional manifestations of low peripheral perfusion.

And in children, it's very important in all patients really to remember that sometimes we start seeing them to be tachycardic, high heart rate, without fever, and that can indicate that they are also trying, starting to to have some hemodynamic compromise. Thank you for that. And you talked about children and elderly patients. We have a question about another specific patient population. For pregnant patients that have either confirmed or

suspected dengue, what immediate inpatient management steps should be prioritized? And when is transfer to a tertiary center appropriate? Yes, so very important for pregnant patients.

The current recommendations is to always hospitalize pregnant patients. There is currently some efforts to review the available evidence for specific questions with pregnant women. But as of now, the recommendation is that every pregnant woman with dengue should be hospitalized. Important to remember that not all pregnant women will require IV fluids. And as with other patients, we administer IV fluids in them when they are necessary because they don't tolerate oral fluids or because there are warning signs.

We also have a more restrictive fluid strategy with pregnant women. We use usually lower IV fluids rates for them, 5 to 10, for example, mL per kilogram when we manage shock with them. And if the patient is in labor or is close to labor, medical care should be provided in a tertiary hospital. There is increase of hemorrhage and other complications for mother and baby. And so if the if the dengue diagnosis is down close to labor or in patients with labor, that would be the recommendation.

The route of delivery in patients with dengue, pregnant patients with dengue is based on individual circumstances. And as I mentioned, there are some reviews underway to review the evidence and provide additional specific recommendations for pregnant women. But as of now, those will be the recommendations.

Great, thank you. Next question asks, is there a hematocrit level at which you would consider a transfusion? And if so, what is it?

Oh, that's a very interesting question. So for patients with dengue, it's important to remember that there are no recommendations for prophylactic transfusions of any kind. Platelets go down and they have could be very important thrombocytopenia, but if the patient is not bleeding, there is no recommendation to do any transfusion for platelets. If there is bleeding, of course, we follow the normal, the regular guidelines for transfusion in patients with bleeding, but there are no special considerations for patients with dengue, no prophylactic transfusions. We don't treat the number of platelets, we treat the patient. For hematocrit levels, which we follow the general recommendations for transfusion among other patients, what we mostly see with patients with dengue, is hemoconcentration, so an increase in the hematocrit during the critical phase. And we follow general guidelines for transfusion as we would do with any other patients. We really don't do anything different if the patient is not, doesn't have active bleeding.

Great, thank you. And we have time for just one last question. And the question asks, how can clinicians distinguish dengue from other conditions on a differential diagnosis such as Chikungunya, Zika, malaria, leptospirosis, or even bacterial sepsis?

That is a question that I don't know if I have enough time to answer, but yes, dengue can look a lot like other things. And so we recommend as with any other disease to have great information about the exposure of the patient, travel history, and also consider the epidemiology and the seasonality of the different pathogens that might be causing the illness. For clinical manifestations during the first two, three days of disease, it's really hard to differentiate between dengue and other diseases. It can be can be really hard, but there's some clinical cues that can help with dengue.

Flushing is very characteristic of patients with dengue, and we've seen in some analysis that we've done that that helps differentiate a little bit. Thrombocytopenia and leukopenia are more common in patients with dengue than there are in patients with Chikungunya or Zika, for example.

There are a few clinical symptoms and clinical lab findings that can help guide the suspicion while you have access to testing results for diagnosis. However, the main recommendation, because it might be many times very difficult to differentiate if you don't have testing available right away, is that you, if you suspect dengue, you monitor that patient as a patient with dengue, you teach the patient about warning signs, you are aware of warning signs and evaluate warning signs in all of these patients so that you don't miss if this patient has dengue, you don't miss the critical phase and you don't miss warning signs and progression to severe disease.

Wonderful. Thank you so much for that comprehensive response. I think that's a perfect question to end our COCA Call on today.

This concludes our Q&A session, and I want to thank everyone for joining us today with a special thanks to our presenters for sharing their time and expertise with us on this timely topic.

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Again, thank you for joining us for today's COCA Call and have a great day.