Methicillin-Resistant Staphylococcus aureus (MRSA)
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SLIDE 1
Hi. I'm Zack Moore, medical epidemiologist with the Communicable Disease Branch of the North Carolina Division of Public Health. This presentation will cover Methicillin-Resistant Staphylococcus aureus, or MRSA.

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At the end of this presentation, you should be able to recognize the difference between colonization and infection; identify proven routes for transmission of MRSA; and locate MRSA control measure information on the NC Division of Public Health and CDC websites.

SLIDE 3
Staphylococcus aureus, which I will call "staph" for short, are bacteria that look like clusters of grapes when seen under a microscope on a Gram stain. Staphs are very hardy organisms, and are resistant to heat, drying, and high salt concentrations. These features allow them to live on skin and on surfaces in the environment for long periods of time.

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MRSA stands for Methicillin-Resistant Staphylococcus Aureus. MRSA is a type of staph that is not killed by methicillin or by other antibiotics that are commonly used for staph infections.

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Since there are many misconceptions about MRSA, I will also discuss what MRSA is NOT. MRSA is NOT A "super-bug". Unfortunately, there are some types of bacteria that can't be treated with antibiotics, but MRSA is not one of them. Infections are treatable, and MRSA skin infections are usually susceptible to antibiotics that can be taken by mouth. MRSA is also not a "flesh-eating bacteria": It can cause necrotizing fasciitis in rare cases, but most infections are more mild.

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MRSA poses a significant public health burden. In a study of 11 emergency departments nationwide conducted during 2004, MRSA was found to be the leading identifiable cause of skin and soft tissue infections. The CDC has estimated that 94,000 invasive MRSA infections occur in the US each year, with most of these being linked to healthcare settings. These infections result in an estimated 19,000 deaths each year.

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Methicillin resistance, like all antibiotic resistance, is ultimately driven by antibiotic use. Staph aureus is known as a master of resistance, and drug resistance usually develops quickly after new drugs are introduced. Methicillin resistance was first seen in the 1960s in hospitals and other healthcare settings. MRSA became increasingly common in

hospitals during the 1970s through 1990s. Newer strains emerged in the 1980s in people with no exposure to healthcare settings, and infections caused by these community-associated strains have increased dramatically from the late 1990s though the present. MRSA did not escape from the hospitals into the community; these new strains are best thought of as distant cousins of the older healthcare-associated strains.

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MRSA can found in many locations in the body and in the environment. It is commonly found in the nose. Other potential sites include the skin, intestines, and throat.

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As I noted earlier, MRSA can persist for prolonged periods in the environment. It can be found on surfaces in many settings; particularly, surfaces that are touched by many people. However, just because MRSA can be found on these surfaces does not mean they are an important source of infection. Outbreak investigations have shown that direct person-to-person contact and sharing of contaminated personal items, such as towels or razors, are much more important sources of infection than contact with environmental surfaces.

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MRSA can also be found in many types of animals. Human strains can be transmitted to and from household pets, and several other strains are present in farm animals. However, the strains that are commonly found in farm animals are rare in humans in the US.

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When talking about staph, it's important to understand the difference between colonization and infection. When we say a person is "colonized", we mean that the organism is living somewhere on or in that person's body without causing disease. This is also called "carriage". Many hospitals do surveillance cultures on patients to determine who is colonized and who is not. A person can be colonized with staph, but never develop an infection. In fact, most people who are colonized with staph will never develop any illness from it. "Infection" refers to an illness caused by the organism.

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Staph colonization is very common. The best information we have about staph colonization in the US comes from the National Health and Nutrition Examination Survey or NHANES. As part of this survey, nasal swabs were collected from randomly selected, non-institutionalized individuals at least 1 year of age. These nasal swabs were first collected during 2001–2002, and then again during 2003–2004. More than 9,000 people were swabbed during each 2 year period.

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In 2001 and 2002, 32.4% of people were found to be colonized with staph aureus. Based on this, it was estimated that 89 million people in the US were colonized.

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Less than 1% of people in the survey were found to be colonized with MRSA, although even this small proportion would mean that 2.3 million people were colonized with MRSA nationwide.

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When the survey was repeated, the proportion of people colonized with staph aureus had decreased slightly overall, but the proportion colonized with MRSA had nearly doubled to 1.5%, or an estimated 4.1 million people nationwide.

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Although only 1.5% of the population was found to be colonized with MRSA in the second NHANES study, a higher proportion, up to 10-20%, of colonization has been found in studies of other settings, including pediatric clinics, child care centers, and prisons. The NHANES data probably represents a lower end estimate since they are based on nasal swabs, which would also miss colonization in other areas, such as the skin or throat.

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MRSA infections occur when the bacteria finds a way to penetrate the body's natural barriers. This is usually through a break in the skin, sometimes through minor cuts or scrapes that are too small to notice. Staph can also penetrate into the lungs if breathing surfaces are inflamed from colds or flu. Secondary infection with MRSA is one of the leading causes of influenza-associated deaths in children. Once MRSA has penetrated, it can cause a wide variety of problems. Skin and soft tissue infections are by far the most common, including cellulitis and boils or abscesses. However, MRSA can infect any organ system in the body and, less frequently, can cause infection of the bloodstream, bones, joints, lungs, heart or other organs. Disseminated infections can be difficult to treat and sometimes fatal.

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These photographs from the Texas Department of Health show a typical MRSA skin lesion with a central collection of pus, surrounded by an area of redness and swelling. These lesions often drain spontaneously, leaving an open, draining lesion like the one shown on the right. These lesions are highly infectious and can be a major source of transmission to others if not covered appropriately. They are often mistaken for spider bites, particularly in the early stages of infection.

SLIDE 20
These images from CDC show similar skin lesions that have ruptured, but continue to drain.

SLIDE 21
Studies have shown that MRSA is often transmitted by direct skin-to-skin contact, and particularly by contact with draining lesions, like those on the previous slides, or with soiled bandages. Transmission can also occur through shared contact with personal

items, such as razors, towels, and sports equipment, that have come in contact with skin lesions.

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Other potential routes that have NOT been shown to play a major role in transmission include coughing and sneezing, and contact with non-personal items, such as pencils, paper, or books. Since MRSA cases often cause great alarm, particularly in school settings, and sometimes in office settings, it's important to emphasize that just being in a room with an infected person does not pose a significant risk of infection.

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MRSA outbreaks have been reported in many different groups, including athletes, military recruits, childcare center attendees, and IV drug users. These groups can have several features in common, including crowding and sharing of personal items; a high degree of close personal contact; a high likelihood of getting skin injuries, such as cuts or scrapes; and, in some cases, poor hygiene.

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Next we will discuss ways to stop the spread of MRSA. Although you can't avoid contact with MRSA altogether, there are simple steps that can be taken to prevent infection. The single most important control measure is thorough handwashing using soap and water. Alcohol-based hand sanitizers will also kill MRSA. Careful wound care is important to prevent infections. This includes keeping cuts and scrapes clean, dry and covered until they have healed completely. People should avoid sharing personal items such as towels or razors, which are often contaminated with staph. Finally, avoid contact with other people's wounds or with bandages that are soiled. Those who must have contact with soiled bandages should wear gloves and wash their hands thoroughly after handling them.

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This slide shows examples of MRSA prevention messages developed by the CDC to highlight these steps.

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This slide lists six basic control and prevention measures to consider in outbreak situations. First, it is important to enhance surveillance to make sure that all cases have been identified. This is important in order to understand the scope of the outbreak and to identify contacts. Patients should be referred for testing and treatment whenever possible. Healthcare providers should be encouraged to obtain cultures, and to use appropriate antibiotics. The NC Consensus Guidelines for Management of Suspected Community-Associated MRSA are a good resource for providers, and are available online. Provide education about the importance of good wound care, including avoiding contact with other people's wounds or bandages. Basic hygiene should be promoted, particularly thorough handwashing and not sharing personal items. Exclusion of patients from certain activities might be necessary in some situations if draining lesions can't be adequately covered. Examples might include toddlers who won't leave

dressings in place, or athletes whose dressings might be displaced during competition. Efforts should be made to achieve and maintain a clean environment to prevent the spread or contamination of surfaces, especially those that come in contact with bare skin. However, remember that environmental cleaning is NOT a substitute for appropriate hygiene measures.

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Finally, remember that although MRSA cases are not individually reportable, local health departments should report outbreaks that are of public health significance. Consultation is available from your CD nurse consultant or from the Communicable Disease Branch epidemiologist on call.

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Detailed information about MRSA prevention and control is available from the North Carolina Division of Public Health and from the CDC at the websites listed here.

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This slide lists references used for this presentation. Thank you.