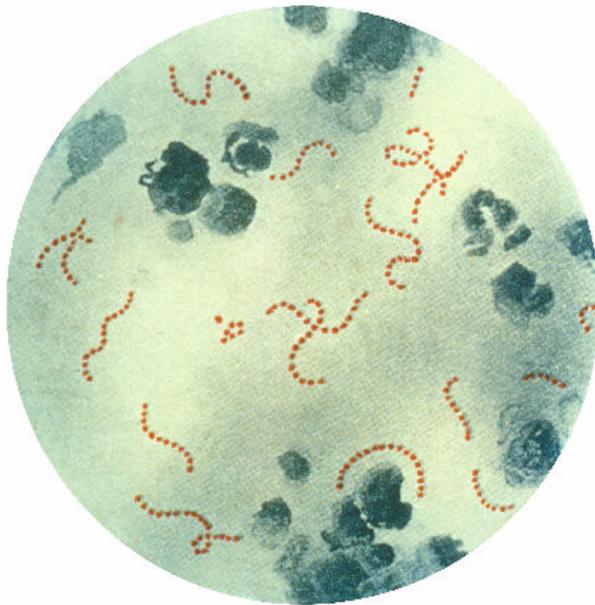


SURVEILLANCE SUMMARY

INVASIVE GROUP A STREPTOCOCCAL DISEASE



Photomicrograph of Group A *Streptococcus*.
Image #2110 from CDC's Public Health Image Library
available at: <http://www.cdc.gov/phil/>

**Ohio Department of Health
Infectious Disease Surveillance
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Invasive Group A Streptococcal Disease Surveillance

Infection with group A *Streptococcus* can produce a myriad of diseases ranging from mild, such as pharyngitis and impetigo, to moderate, such as scarlet fever and erysipelas, to severe, such as necrotizing fasciitis, meningitis and streptococcal toxic shock syndrome.¹ The majority of group A streptococcal infections are mild, but severe, invasive disease occurs when the bacteria infect normally sterile sites such as the blood, cerebrospinal fluid, bone, joint, muscle or other internal organs.²

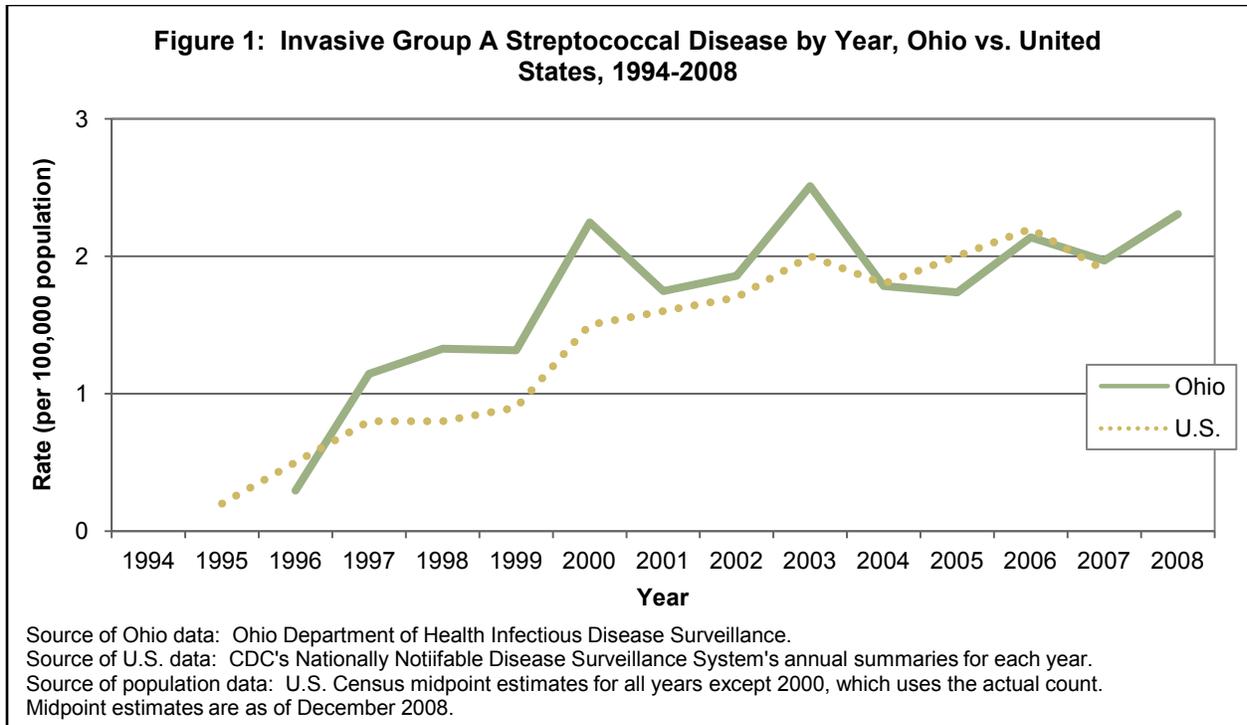
Public Health Reporting Requirements

Invasive group A streptococcal became nationally notifiable in 1995 and reportable in Ohio in 1996. In Ohio, it is a class B(2) reportable disease, meaning all cases, suspected cases and positive laboratory results are to be reported to the health department by the end of the work week. A confirmed case is defined as a clinically compatible individual with isolation of group A *Streptococcus* by culture from a normally sterile site.^{3,4}

Streptococcal toxic shock syndrome is also reportable in Ohio and the United States. It is a class B(2) reportable disease in Ohio and should be reported following the same guidelines and time frames as invasive group A streptococcal disease. The surveillance case definition defines a confirmed case as a clinically compatible person with hypotension and multi-organ involvement with isolation of group A *Streptococcus* by culture from a normally sterile site. A probable case is defined as a clinically compatible individual with hypotension and multi-organ involvement but with isolation of group A *Streptococcus* from a non-sterile site.^{5,6}

Burden of Invasive Group A Streptococcal Disease

Each year, 9,000 to 11,500 cases of invasive group A streptococcal disease occur in the United States, of which 1,000 to 1,800 result in death.² Severe group A streptococcal disease incidence began to increase during the late 1980s in the United States⁷ and was made nationally notifiable in the mid-1990s. Figure 1 demonstrates the incidence rate rising approximately nine and one-half times in the United States since public health surveillance for the condition began. Ohio followed this nationwide upward trend, where the rate of disease increased seven-fold from 1996 to 2008. Moreover, Ohio's incidence rate exceeded the national incidence rate 1997-2003, while rates were comparable 2004-2008.



Causative Agent

Invasive group A streptococcal disease is caused by sphere-shaped bacteria arranged in chains called *Streptococcus pyogenes*.⁷ There are more than 130 different serotypes of *S. pyogenes*.¹ Group A streptococci are distinct from other streptococci in that they contain M proteins in their cell walls, which help them resist the body's immune response by evading phagocytosis.⁷ Group A streptococci are also beta-hemolytic, meaning they can completely break down red blood cells.⁷ Beta-hemolysis is characteristic of, but not exclusive to, group A streptococci.⁷

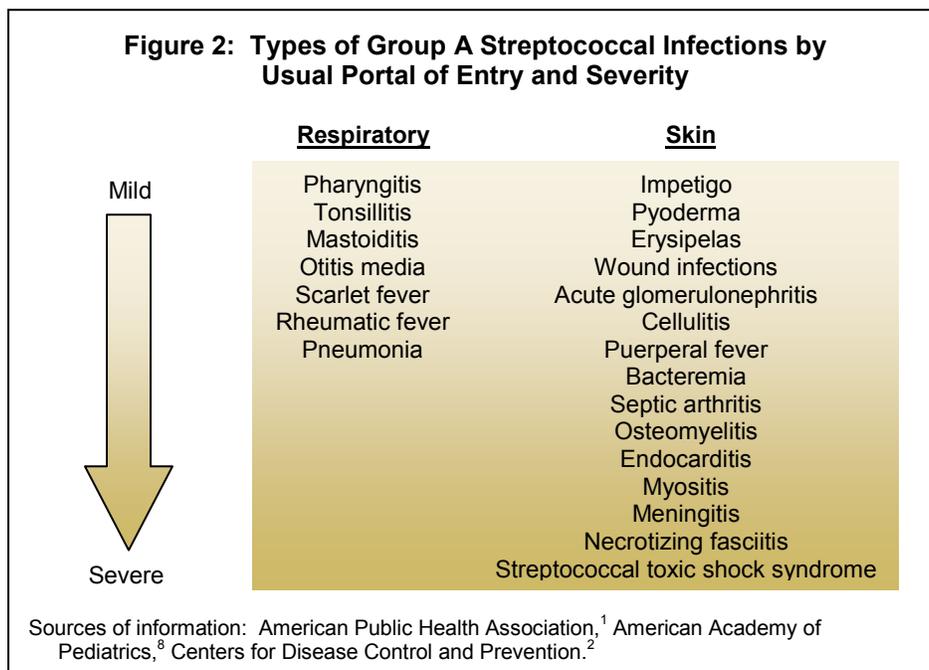
Transmission

Group A streptococci are transmitted through respiratory droplets or direct skin contact with infected persons.¹ Although rare, foodborne transmission has also occurred through improper preparation and refrigeration techniques;⁸ implicated food items have included milk and milk products.¹ Most severe, invasive group A streptococcal infections follow a skin or soft tissue infection and rarely follow an episode of pharyngitis.⁸

Individuals infected with group A *Streptococcus* usually become ill in one to three days and remain infectious for 10 to 21 days; although some with more serious disease are contagious for weeks to months following infection.¹ Persons who are sick, such as those with pharyngitis or skin infections, are the most likely to transmit the disease to others; however, it is possible for asymptomatic persons to also spread disease, although they are less likely to be contagious.² Up to 15 percent of children can be asymptomatic carriers of group A *Streptococcus*.⁷

Clinical Presentation

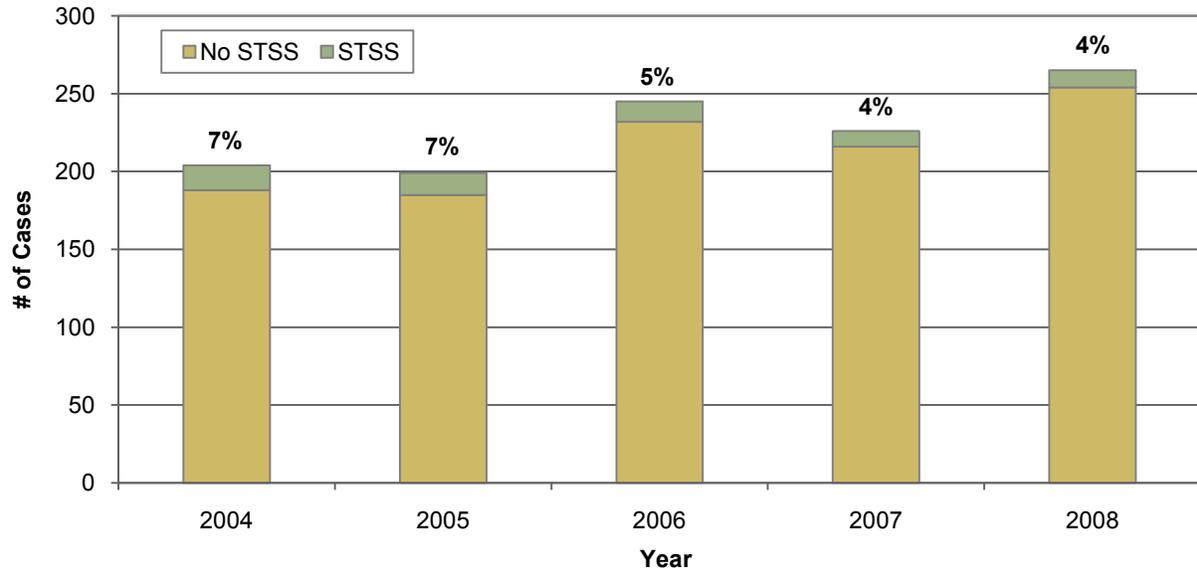
Persons infected with group A *Streptococcus* range from being asymptomatic, having a mild illness or having a severe illness. The most common symptoms are pharyngitis and skin infections such as impetigo.¹ Some acute respiratory tract infections progress to scarlet fever or rheumatic fever.⁸ Figure 2 displays various group A streptococcal infections by the usual portal of entry and by increasing severity.



Invasive group A streptococcal disease may manifest as pneumonia, bacteremia, deep soft tissue infection (such as necrotizing fasciitis or myositis), meningitis, peritonitis, osteomyelitis, septic arthritis, postpartum sepsis (puerperal fever) and neonatal sepsis.⁴ An average of 6 percent to 7 percent of persons with invasive group A streptococcal disease will develop streptococcal toxic shock syndrome.² Streptococcal toxic shock syndrome is a group A streptococcal infection characterized by hypotension and multi-organ involvement through renal impairment, coagulopathy, liver involvement, acute respiratory distress syndrome, a generalized erythematous rash and/or soft tissue necrosis.

In Ohio, 5 percent of invasive group A streptococcal disease cases 2004-2008 also had streptococcal toxic shock syndrome (Figure 3). The percent decreased over the years from 7 percent in 2004 to 4 percent in 2008, but this was a function of an increase in the overall number of cases of invasive group A streptococcal disease without an increase in the number of cases with streptococcal toxic shock syndrome as well. For all years assessed, Ohio's proportion was at or below the national average proportion of 6 percent to 7 percent.

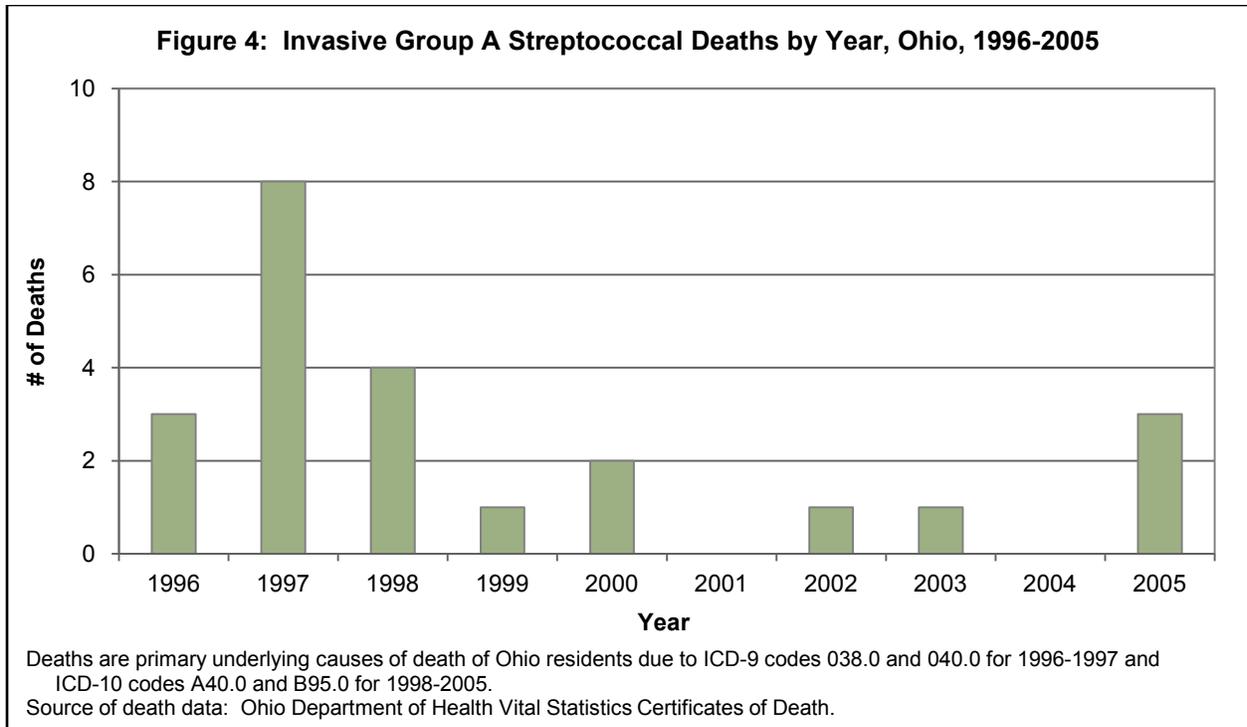
Figure 3: Invasive Group A Streptococcal Disease Cases that Developed Streptococcal Toxic Shock Syndrome, Ohio, 2004-2008



Source of disease data: Ohio Department of Health Infectious Disease Surveillance.

Ten percent to 15 percent of individuals with invasive group A streptococcal infections die from their infections; however, this increases to 25 percent of those with soft tissue infections and 35 percent of those with streptococcal toxic shock syndrome.²

Death certificate data analyzed for Ohio residents show the primary underlying cause of death due to group A *Streptococcus* has fluctuated during the time invasive group A streptococcal disease was reportable (1996) (Figure 4). International Classification of Diseases (ICD) 9 codes available in 1996-1997 were not specific for group A *Streptococcus*, so the increased number of deaths in these years may be a reflection of deaths due to other types of streptococcal infections. In 1998, ICD-10 codes were implemented, which contained specific provisions for group A streptococcal deaths. During 1998-2005, the median number of deaths due to group A *Streptococcus* was one per year and ranged from zero to four per year.

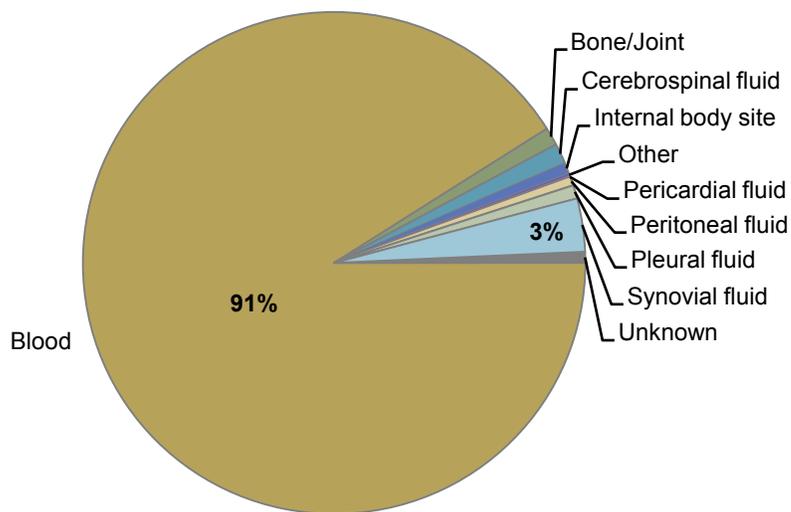


Diagnosis

Group A *Streptococcus* is diagnosed by isolating the organism via culture and then serogrouping the organism as Lancefield group A.¹ To be considered invasive, group A *Streptococcus* must be isolated from a normally sterile site such as blood, cerebrospinal fluid, synovial fluid, pericardial fluid or pleural fluid.⁴ Isolation of group A streptococci from non-sterile sites is not reportable in Ohio or the United States.

Figure 5 shows the specimen sites of invasive group A streptococcal isolates in Ohio 2004-2008. Group A *Streptococcus* was isolated from the blood for the majority of cases (91 percent); 3 percent of isolates were from synovial fluid. Lesser reported specimen sites over the past five years included bone or joint tissues, cerebrospinal fluid, internal body sites, peritoneal fluid, pleural fluid, pericardial fluid, other and unknown specimen sites.

Figure 5: Invasive Group A Streptococcal Isolates by Specimen Site, Ohio, 2004-2008

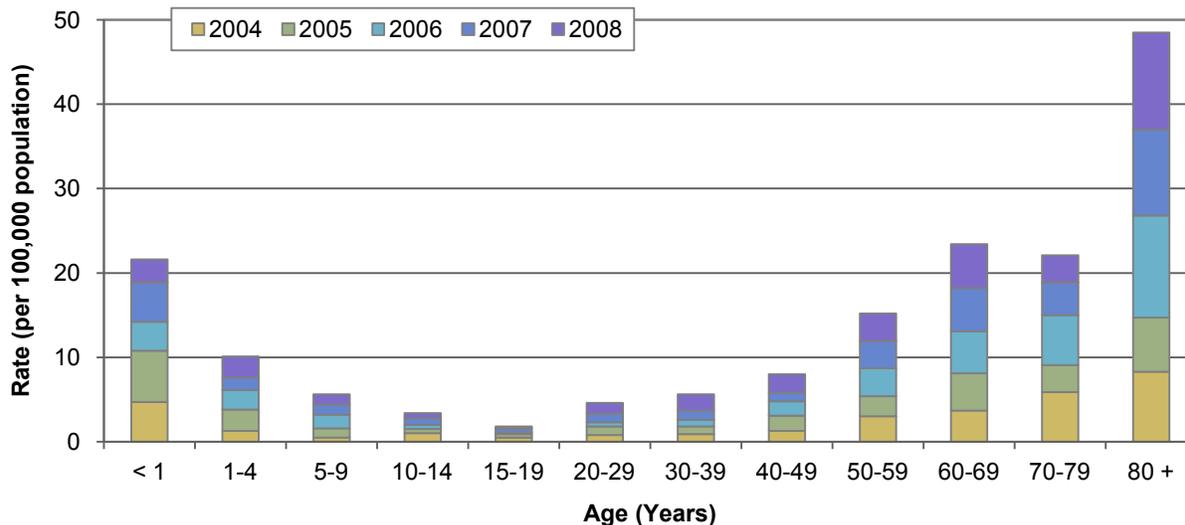


Source of disease data: Ohio Department of Health Infectious Disease Surveillance.

Demographic Trends

Invasive group A streptococcal disease primarily affects infants and older persons.⁸ In Ohio, the highest rate of disease occurred among individuals 80 years of age and older 2004-2008 (Figure 6). The incidence rate was also higher for infants and adults aged 50 years and older. Ohio's lowest rates of disease were observed among teenagers aged 15-19 years.

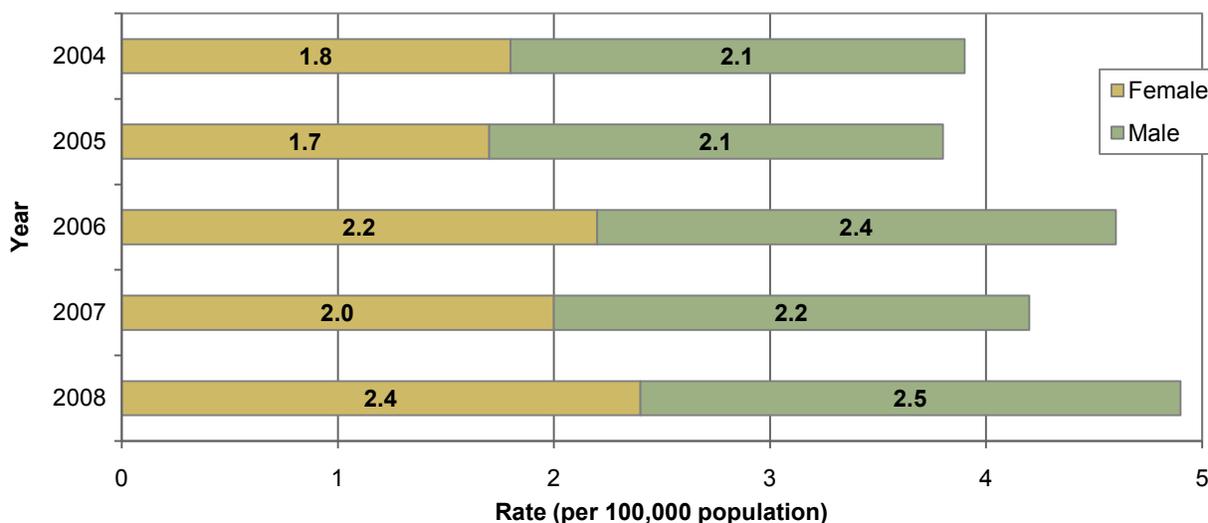
Figure 6: Invasive Group A Streptococcal Disease by Age and Year, Ohio, 2004-2008



Source of disease data: Ohio Department of Health Infectious Disease Surveillance.
 Source of population data: 2000 U.S. Census.
 Age was unknown for less than 1% of cases 2004-2008.

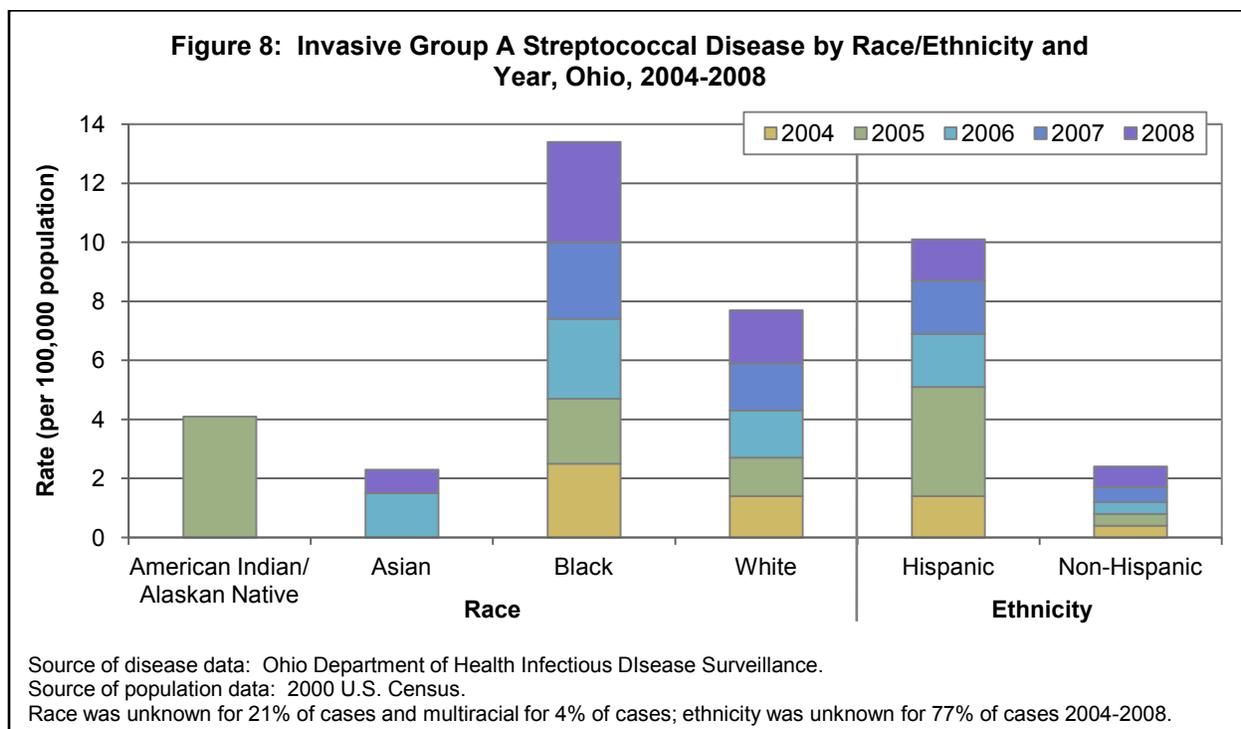
Invasive group A streptococcal disease does not disproportionately affect one sex over the other.⁷ However, in Ohio, males had a slightly higher incidence rate than females for all years during 2004-2008 (Figure 7). The total rate for the five-year period was 2.0 cases per 100,000 population among females and 2.3 cases per 100,000 population among males. This slight disparity may reflect a greater prevalence of risk factors among men in Ohio.

Figure 7: Invasive Group A Streptococcal Disease by Sex and Year, Ohio, 2004-2008



Source of disease data: Ohio Department of Health Infectious Disease Surveillance.
 Source of population data: 2000 U.S. Census.
 Sex was unknown for 2% of cases 2004-2008.

Ethnic and racial disparities in invasive group A streptococcal incidence are believed to be associated with the social factors facilitating the spread and severity of disease such as overcrowding, poverty and inadequate access to medical care.⁷ It is unknown how social factors influenced the differences observed among races and ethnicities in Ohio. The rate of invasive group A streptococcal disease in Ohio among blacks 2004-2008 was 1.8 times higher than the rate among whites (Figure 8). This trend remained consistent for each year assessed. Ethnicity was not reported for 77 percent of cases, but among cases where ethnicity was known, the incidence rate among Hispanics (2.0 per 100,000) was four times greater than the rate among non-Hispanics (0.5 per 100,000) during the five-year interval. However, the true trends with respect to ethnicity cannot be interpreted with certainty because of the substantial amount of missing data.



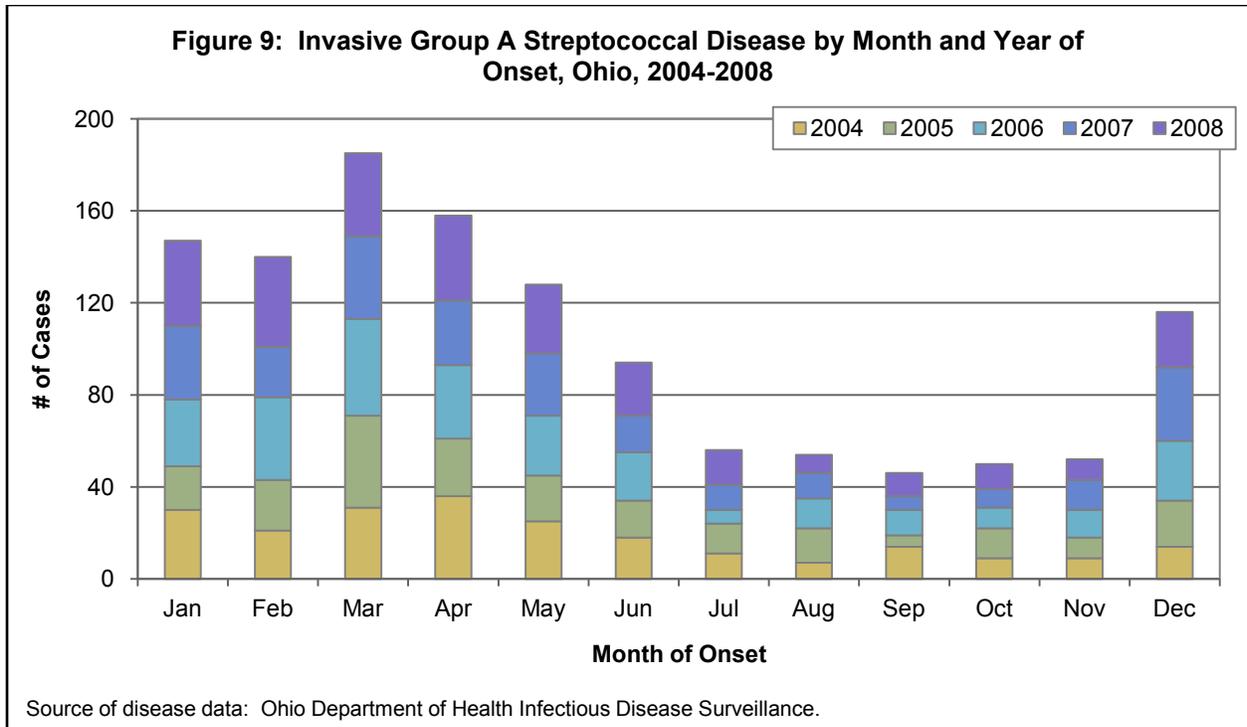
Risk

The majority of those who are exposed to group A *Streptococcus* do not develop severe, invasive disease.² Although healthy individuals can acquire invasive group A streptococcal disease, those most at risk include:

- Individuals with chronic diseases (e.g., cancer, diabetes and heart or lung disease).
- Persons who use immune-suppressing medications such as steroids.
- Persons with skin abrasions such as cuts, chickenpox lesions or surgical wounds.
- Elderly adults.
- Adults with a history of alcohol abuse or injection drug use.²

Seasonal Variation

The incidence of invasive group A streptococcal disease in Ohio over the past five years peaked during the winter and early spring months, particularly in March, while incidence declined through the later spring and summer months (Figure 9).



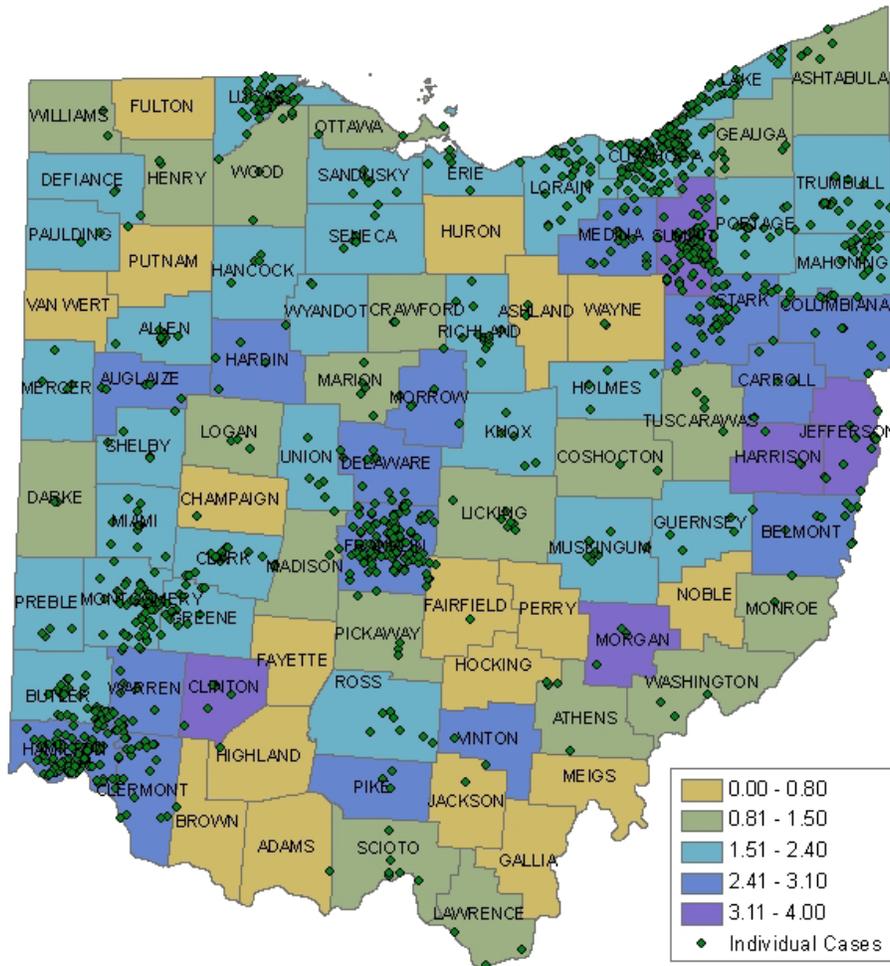
Geographic Distribution

Group A streptococcal disease is endemic worldwide,⁷ but invasive disease is believed to be more common and more severe in lesser developed countries.⁹ In these developing countries, group A *Streptococcus* is estimated to be the third-most common cause of neonatal bacteremia, the fifth-most common cause of community-acquired pneumonia in infants and the most common cause of bacteremia in infants aged 7 to 59 days.⁹ Among children under 15 years of age in developing countries, the case fatality rate of group A streptococcal bacteremia is 25 percent.⁹

In the United States, severe infections due to group A *Streptococcus* were not recognized until the 1920s, but by the late 1980s, the incidence of severe, invasive infections increased.⁷ Also during the late 1980s, streptococcal toxic shock syndrome was first recognized, and rheumatic fever re-emerged after almost disappearing during the previous decade.⁷ In 1990, further attention was given to invasive group A streptococcal infections in the United States when the celebrity Jim Henson died from streptococcal toxic shock syndrome precipitated by group A streptococcal pneumonia.⁷

When looking at 2004-2008 geographic trends for invasive group A streptococcal disease in Ohio, most cases were concentrated around urban areas of the state (Figure 10). However, rates of disease were higher in more rural counties such as Clinton, Harrison, Jefferson and Morgan. Overall, the range of incidence rates per county was from less than 1.0 to 4.0 cases per 100,000 population.

Figure 10: Invasive Group A Streptococcal Disease by County, Ohio, 2004-2008



Rates are per 100,000 population.
 Source of disease data: Ohio Department of Health Infectious Disease Surveillance.
 Source of population data: 2000 U.S. Census.

Outbreaks

The majority of invasive group A streptococcal infections occur as isolated cases; however, outbreaks do occasionally occur.³ Outbreaks of invasive group A streptococcal disease have taken place in hospitals, nursing homes, families and military institutions as well as in the community.³ Nosocomial outbreaks of severe group A streptococcal disease in the United States have been linked to asymptomatic carriers, particularly to operating room staff following surgery.¹

In Ohio, one community outbreak of invasive group A streptococcal disease was reported during the winter of 2000 in Butler, Clermont and Hamilton counties. A total of 25 cases were reported, seven of which also had streptococcal toxic shock syndrome. No substantial epidemiologic connections were found between the cases, and the majority of isolates were unrelated molecularly. It was hypothesized that new strains of group A *Streptococcus* had emerged in a susceptible population and caused the increase in incidence.

Prevention

The most efficacious way to prevent all types of group A streptococcal infections is through diligent hand washing, especially after sneezing or coughing and before preparing and eating foods.²

Early recognition of group A streptococcal infections is important because of the opportunity to reduce the severity and spread of disease and perhaps even prevent fatalities.³ For ill persons with sore throats, prompt diagnosis and treatment of group A streptococcal pharyngitis can prevent transmission to others within 24 hours of treatment.² Those with skin lesions should provide attentive wound care and watch for signs of infection, seeking medical care if the wound becomes infected and especially if fever occurs.² Post-exposure prophylaxis for contacts of persons with invasive group A streptococcal infections is not generally warranted.² However, contacts with underlying disease or other risk factors may be cultured for group A *Streptococcus* and treated appropriately.³

Conclusion

The incidence of invasive group A streptococcal disease has risen in Ohio and the United States over the past decade. In Ohio, this emerging disease most often affected adults 80 years of age and older, infants and blacks over the five years analyzed. In addition, the majority of cases occurred during the late winter/early spring and around the urban areas of the state, but the burden of disease was higher among those in more rural counties.

Several vaccine candidates to prevent group A streptococcal infections are being researched so that perhaps this rising trend can be reversed through an effective vaccination program in the future.¹⁰ Such a primary prevention intervention can prove especially important for those most affected by invasive disease.

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