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Infectious Diseases in Child Day Care Facilities

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Every day, thousands of children in the United States attend day care facilities. These facilities are either day care centers (DCC) that are licensed and regulated by state agencies, or day care homes that may be licensed, are not regulated, and usually provide care for smaller numbers of children than DCC. In these facilities, susceptible hosts, crowded conditions, the poor personal hygiene of young children, and the need for "hands on" care by staff all combine to provide an environment that potentiates transmission of infectious diseases. The most comprehensive studies of diseases in child day care have involved diarrhea, hepatitis A, respiratory tract infections, invasive Haemophilus influenzae type b disease, cytomegalovirus, and immunization-related diseases. These disease states generally have been evaluated in DCC, and extrapolation to other day care facilities may not be entirely appropriate.

Diarrheal Disease

Enteropathogens cause outbreaks within centers and sporadic episodes of disease in children, day care staff and close family members. The primary age group is children less than 2 to 3 years of age. In addition, excretion of enteropathogens, particularly Giardia lamblia and rotavirus, may occur in asymptomatic children; the significance of this phenomenon in transmission is unknown. Although many enteropathogens can cause diarrhea in children in day care, rotavirus, G. lamblia, shigella, and, recently, cryptosporidium, are the main organisms. In many outbreaks, more than one organism may be identified, indicating the propensity for spread of many enteropathogens during outbreaks. The most important correlate of increased frequency of enteric illness in DCC is the presence of young children who are not bowel-trained. Contamination may occur. Outbreaks of diarrhea in DCC. Limited studies indicate that the risk of diarrhea is 30% higher for children in DCC than in age-matched children cared for at home or in family day care. The spread of infection from non-toilet-trained children in centers to their families is common, particularly when shigella, rotavirus, or G. lamblia are the causative agents. To decrease diarrheal disease in day care, staff and parents must be kept aware of modes of transmission as well as practical methods of prevention and control.

Hepatitis A

Unlike diarrhea, infections caused by hepatitis A virus (HAV) may be inapparent among children attending day care, but clinical manifestations of disease are more severe in day care staff and in adult family members. In the day care setting, HAV may cause discrete outbreaks that average 12 cases in size and 3 months in duration, with children 1 to 2 years of age most commonly infected. Persons in contact with these children, eg, parents, siblings, or caregivers, have the highest risk of infection. Attack rates of clinical illness average 15% to 20% among household contacts of 1 to 2-year-old children during outbreaks of hepatitis A. The risk of an outbreak occurring in a DCC is related to: the presence of diaper-aged children in the center; longer hours of operation; and care for over 50 children. Hepatitis A in DCC appears to spread initially among young children, particularly those in diapers, with later secondary spread to adults and children in older age groups. Spread presumably occurs by person-to-person contact; however, the virus may survive in the environment. Indirect transmission via fomites or environmental contamination may occur. Outbreaks of hepatitis A in DCC are characterized by involvement of children who have mild or asymptomatic infection and involvement of adults (parents and staff) who are the major group with clinical hepatitis. Outbreaks of hepatitis A are usually recognized because of illness in family members. Persons who have contact with 1 to 2-year-old children have the highest risk of infection. Prevention relies on measures similar to those used to prevent gastroenteritis.
Acute Respiratory Illness

Viruses that cause respiratory tract infections affect children, DCC staff, and close family members. Comparing young children in day care facilities with children kept at home, there appears to be a higher frequency in day care; however, with increasing age, rates decrease in both groups. Because of the ease of transmission of viruses that cause respiratory tract illness and the close contact of children in day care, outbreaks of respiratory tract illness are common. The agents responsible for these illnesses and their relative importance in children in day care have been shown to be similar to those that account for illness in homebound children and include respiratory syncytial virus, parainfluenza viruses, adenoviruses, enteroviruses, and rhinoviruses. Modes of transmission include aerosols, respiratory droplets, direct contact with infected secretions, and fomites. Respiratory viruses may remain viable in moist or dry secretions on nonporous surfaces and objects for hours or days. According to limited studies evaluating day care attendance as a risk factor for respiratory tract infections and otitis media, children attending DCC are at higher risk; however, a thorough understanding of the relationship between day care attendance and the occurrence of respiratory tract infections and otitis media requires additional studies.

Invasive *Haemophilus influenzae* Type b Disease

Clinical manifestations of severe infection caused by *H. influenzae* type b occur primarily among young children, particularly those younger than 2 years of age, and only rarely affect close family members or day care personnel. Although attendance at a DCC may significantly increase the risk of a child developing primary invasive *H. influenzae* type b disease, there is lack of agreement as to which age groups between 1 month and 4 years of age are at highest risk. Risk also increases with the size of the center, with children older than 18 months having a 53-fold risk if they attend centers with more than 19 children. Secondary transmission within a family once a primary case has occurred, leads to invasive *H. influenzae* type b disease with significantly increased frequency in household contacts less than 4 years of age, particularly in those less than 2 years of age. Studies evaluating whether there is increased risk of secondary cases in day care settings have varied from 0% attack rate for classroom contacts of a case to 2.7% attack rate for contacts younger than 24 months of age. The organism is spread via the respiratory route and the rate of colonization of other children at a DCC following an index case is high. Rifampin prophylaxis of contacts is usually reserved for use in those facilities in which two or more cases of invasive disease have occurred within 60 days. Children in day care should be immunized with *H. influenzae* type b capsular polysaccharide vaccine at 24 months of age.

**Cytomegalovirus**

Infections caused by cytomegalovirus (CMV) may be inapparent among children in day care and their adult contacts, but these infections may have serious consequences for the fetus of pregnant contacts, and for certain immunocompromised hosts. Excretion of CMV is uncommon among infants under 1 year of age, with peak rates of viral shedding in 2 year olds. Children in DCC may shed CMV for 2 years, or longer, after acquisition. Surveys of CMV excretion by children in various DCC showed that 10% to 80% shed CMV in urine and saliva. From 50% to 100% of workers from DCC and parents of children in DCC have antibody to CMV. Longitudinal serologic follow-up of seronegative parents revealed that children in DCC who excrete CMV commonly transmit CMV to their parents as shown by seroconversion. The high prevalence of silent CMV infections among children in day care argues against exclusion of any child known to have CMV infection. These children serve as a source of transmission to their parents and to staff.

### Table 1. Infections in Children in Day Care by Organ System

| Organ system or condition          | Organism or disease                  |
|-----------------------------------|--------------------------------------|
| Gastrointestinal tract and liver  | *Shigella* spp.                       |
|                                   | Rotavirus                             |
|                                   | *Giardia lambia*                      |
|                                   | *Cryptosporidium* spp.               |
|                                   | Hepatitis A                          |
| Respiratory tract                 | *Respiratory syncytial* virus         |
|                                   | *Parainfluenza* virus                 |
|                                   | *Adenovirus*                          |
|                                   | *Rhinovirus*                          |
|                                   | *Coronavirus*                         |
|                                   | *Haemophilus influenzae*, type b      |
| Multiple organ systems            | *Cytomegalovirus*                     |
| Vaccine-preventable diseases      | *Diphtheria*                          |
|                                   | *Measles*                             |
|                                   | *Mumps*                               |
|                                   | *Rubella*                             |
|                                   | *Pertussis*                           |
|                                   | *Poliomyelitis*                       |
|                                   | *Tetanus*                             |

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Vaccine-Preventable Disease
The widespread use of vaccines against measles, mumps, rubella, poliomyelitis, diphtheria, pertussis, and tetanus has resulted in reductions in the risks posed to children in the day care environment. Major outbreaks due to these diseases in day care facilities are quite infrequent. The majority of states have laws that require immunization of children attending licensed day care facilities. Antibody titers are higher in children attending DCC than in children of the same age not attending DCC; however, because many children currently enter day care facilities at young ages, they may not have completed primary immunizations before enrollment and may be susceptible. Staff in day care facilities can acquire and transmit communicable diseases; hence, it is important that they be immune.

Summary
Infections in children in day care are common, but can be limited by education of providers and staff in standards of hygiene, maintenance of basic techniques of infection control, appropriate use of the physical facilities of the day care unit, and maintenance of recommended levels of children and staff.

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CASE REPORT
A 29-year-old Hispanic woman was admitted to the hospital because of 2 days of chills, fever, nausea without vomiting, myalgias, frontal headache, and pain in her left ear (without discharge). Ten days before admission, because of frequency of urination without dysuria or fever, a clean-catch specimen of urine was cultured (reported subsequently to have yielded >10⁹ Escherichia coli/ml), and trimethoprim-sulfamethoxazole (TMP-SMX) was prescribed. She was instructed to take one tablet (160 mg TMP + 800 mg SMX) every 12 hours for 10 days; she recalled omitting two doses about four days before entry. The urinary frequency disappeared after the second dose of TMP-SMX.

She had traveled to Mexico about 2 months before entry, staying a period of hours; she had no symptoms of any illness subsequently. A beach camping trip the weekend after she commenced treatment with TMP-SMX was not associated with insect bites or contact with wild or feral animals. There was no contact with ill humans.

Seven years previously, during pregnancy, she had a "kidney" infection. There was no history of use of alcohol or IV drugs, but she smoked about one pack of cigarettes per day, and occasionally used marijuana. She is sexually active and heterosexual, with a heterosexual partner.

On examination, her temperature was 103.8°F, pulse 104, and blood pressure 102/50 (nonpostural). She appeared to be acutely ill, lying huddled under blankets, shaking. There was no skin rash. Nodes were palpable in right cervical, both axillary, and right occipital regions. Both palpebral conjunctivae were injected. The ears were normal, as was the pharynx. There was a soft apical systolic murmur. The remainder of the physical examination did not disclose any abnormalities—specifically, of the thyroid gland, costovertebral regions, liver, or spleen.

All formed elements of the peripheral blood were decreased at entry, and fell to a nadir around 48 hours after admission (Table 1). The morphology of the white and red blood cells was normal. The urinalysis was normal, as were blood chemistries, chest film, cultures of blood and urine, and a Mono-Spot test.

She defervesced within 24 hours and remained afebrile. As the cytopenias repaired spontaneously, she was discharged 6 days after admission.

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