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CHAPTER 5: EMERGING INFECTIOUS DISEASES

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CHAPTER FIVE: EMERGING INFECTIOUS DISEASES

“People are beginning to understand there is nothing in the world so remote that it can’t impact you as a person.”—William H. Foege, Director, US Centers for Disease Control, 1977–1983

As the global community becomes smaller and more interconnected with the ease of international travel, the spread of emerging or re-emerging infectious diseases becomes an ever-growing threat to the medical community, and it is critical that the pediatric health care community be prepared to safely manage patients with highly infectious and highly contagious infectious diseases (also referred to as highly hazardous communicable diseases [HHCDs]). These diseases, such as Ebola virus, avian influenza, severe acute respiratory syndrome (SARS), and Middle Eastern respiratory syndrome (MERS), can be spread from human to human from a variety of ways, depending on the pathogen, and most carry with them a high mortality rate and no available vaccine or cure.

In the case of Ebola virus, the virus is spread via contact, and although the virus is considered highly infectious, it is not highly contagious. In contrast, MERS is a contagious respiratory pathogen spread via respiratory droplets and requires strict airborne precautions (**Table 5.1: Examples of Highly Hazardous Diseases Requiring Special Isolation**). Preparing for HHCDs in pediatrics must include not only hospital environments but also outpatient facilities, where a majority of pediatric care is delivered. Care of these unique patients is labor intensive and requires extensive specialized training and should occur in biocontainment facilities when possible. However, *all* institutions caring for children should be capable of mastering the tenets of infection prevention and control, biocontainment, and isolation of children with a suspected or confirmed HHCD. This section will review the basic guidelines for recognizing, isolating, and safely managing children with highly hazardous infectious diseases.

Table 5.1: Examples of Highly Hazardous Diseases Requiring Special Isolation	
Pathogen	Transmission-Based Precaution
Pandemic influenzas (including avian influenza)	Standard, Contact, Airborne (www.cdc.gov/flu/avianflu/novel-flu-infection-control.htm)
Viral hemorrhagic fevers <ul style="list-style-type: none"> • Ebola virus • Marburg virus • Lassa fever • Crimean-Congo fever 	Standard, Contact, Airborne (www.cdc.gov/vhf/ebola/healthcare-us/ppe/index.html)
Coronaviruses <ul style="list-style-type: none"> • Severe acute respiratory syndrome (SARS-CoV) • Middle Eastern respiratory syndrome (MERS-CoV) 	Standard, Contact, Airborne (www.cdc.gov/coronavirus/mers/infection-prevention-control.html)
Smallpox	Standard, Contact, Airborne (www.cdc.gov/smallpox/clinicians/diagnosis-evaluation.html)
Monkeypox	Standard, Contact, Airborne (www.cdc.gov/poxvirus/monkeypox/clinicians/infection-control-hospital.html)
Multidrug-resistant tuberculosis (MDR-TB)	Standard, Airborne (www.cdc.gov/tb/publications/factsheets/prevention/ichcs.htm)

MAJOR PRINCIPLES IN PEDIATRIC BIOCONTAINMENT

Infectious diseases remain among the leading causes of morbidity and mortality worldwide, especially in resource-limited countries. Reasons for this continued threat include the emergence of new infectious diseases as well as re-emergence of known infectious diseases after significant decline in the population. Examples of pathogens appropriate for special isolation are included in **Table 5.1: Examples of Highly Hazardous Diseases Requiring Special Isolation**. When preparing for these HHCDs, there are special issues facing children and their families that must be carefully considered. These issues include processes to screen and identify patients, appropriately isolate patients of concern, arrange for the optimum level of care for these unique patients, and communicate with and include family members in care delivery (**Table 5.2: Preparedness Steps for a Child with a Suspected EID: Identify, Isolate, and Inform**).

Table 5.2: Preparedness Steps for a Child With a Suspected EID: Identify, Isolate, and Inform		
Preparedness Steps	Possible Challenges	Potential Solutions
<p>Identify</p> <p>Relevant signs and symptoms and travel history</p>	<ul style="list-style-type: none"> • Cocirculating and seasonal infections may have similar presentations as HHCDs • Many competing priorities in institutions make screening difficult • Language/cultural barriers exist • Sustaining interest and enthusiasm • Keeping up to date on relevant HHCDs 	<ul style="list-style-type: none"> • Practice triage questions signs and symptoms and travel history that trigger appropriate actions to isolate and inform • Keep up-to-date information readily available (websites, designated infectious disease experts) • Simple signage in multiple languages at entry points for patients/help families to self-identify • Prioritize simple simulations: Mystery patient and tabletop drills
<p>Isolate</p> <p>Mask patient, separate from other patients, place in pre-designated isolation room</p>	<ul style="list-style-type: none"> • Accompanying family members may also be infectious • Designated isolation room may be occupied • Disease-specific clinical manifestation and developmental and behavioral issues may impact efforts to contain secretions 	<ul style="list-style-type: none"> • Mask accompanying family members (they could be infectious) • Pediatric and adult masks readily available with loops to secure • Consider security issues • Drill rapid turnover of occupied isolation room to facilitate availability
<p>Inform</p> <p>Internal and external stakeholders</p>	<ul style="list-style-type: none"> • Requires both internal and external communication structure • Rapid turnover of trained health care worker staff and administration • Unfamiliar with local health department staff 	<ul style="list-style-type: none"> • Tabletop drills • Up-to-date phone trees • Testing of communication pathways • Protocol to alert local health department • Easy access to contact information

Although several highly specialized biocontainment units have been created in the United States, there are few beds available for pediatric patients with confirmed HHCDs.

INFECTION PREVENTION AND CONTROL AND PERSONAL PROTECTIVE EQUIPMENT

The first step in managing patients suspected of HHCD is identifying those at high-risk for infection on the basis of travel and symptom screening. Patients who are identified with a potential HHCD should be immediately placed in isolation, preferably in a negative-pressure

ventilation room, until a full assessment and diagnostic testing, if indicated, can be performed. For viral hemorrhagic fevers, the personal protective equipment (PPE), as well as the process for donning and doffing, is well outlined by the CDC and should be strictly followed in the event there is a suspected patient. A tiered approach was developed for hospitals during the Ebola outbreak, and is outlined on the CDC Web site (www.cdc.gov/vhf/ebola/healthcare-us/preparing/hospitals.html).

The first tier includes all frontline health care facilities, which should be equipped with PPE, identify and isolate suspected patients in a private room (preferably with a private bathroom or covered commode; a negative-pressure ventilation room should be used whenever possible), initiate testing in low-risk patients, and transfer high-risk patients, if needed, for further care.

Tier 2 hospitals are Ebola assessment facilities that have the capacity to care for the patient for up to 5 days until confirmatory testing is performed. These facilities should have sufficient PPE for staff to safely care for a possible Ebola-positive patient for these 5 days.

Lastly, tier 3 includes Ebola treatment centers, capable of caring for confirmed cases for the duration of illness. In each of these settings, standard contact and droplet precautions should be employed.

In all settings, staff should be appropriately trained in the proper use of PPE and should have a plan in place for how they will manage and dispose of biohazardous trash, safely clean and disinfect patient care areas, and care for staff who are involved in patient care. Additional infection prevention and control measures when evaluating patients under investigation or those confirmed as having Ebola virus disease include the following key components:

- Patient placement in a single room (with an attached bathroom) with log maintained of all persons entering the room
- PPE to be used by health care workers
- Dedicated or disposable medical equipment
- Hand hygiene (includes consistent and appropriate handwashing after removing gloves),
- Active monitoring of all personnel for exposure and signs and symptoms
- Environmental cleaning and management of waste

The specific type of PPE varies, and guidelines are available on the CDC Web site (www.cdc.gov/vhf/ebola/hcp/ppe-training/index.html).

Regardless of which type of PPE each institution chooses, it has been shown that the proficiency of use and specific training and practice in donning and doffing PPE is most important. This requires active and consistent, ongoing training (at least quarterly), including computer simulation and spoken instructions. Compared with passive training, active training leads to fewer errors among health care staff.

SCREENING AND IDENTIFICATION

Whether patients are being seen in the emergency department or in another outpatient setting, travel screening should be a part of every child's intake questionnaire as well as a general symptom screen. Although this can be an understandably daunting task with the large amount of

international travel that occurs in today's world, encouraging frontline staff to incorporate travel screening into initial history taking is key in identifying patients with possible HHCDs. It is reported that 34% of children with recent travel are diagnosed with infections, and travel screening is important in diagnosing even common febrile illnesses associated with the pediatric traveler.

When considering HHCDs, each institution should work closely with their own infection control and infectious disease staff to identify key screening questions, and frontline staff should be kept up-to-date if possible on the current "hot spots" for emerging infections and outbreaks, which will change over time. All frontline providers caring for children should be prepared to screen, identify, and isolate suspected patients and rapidly inform the proper authorities (eg, infection control and infectious disease teams, local/state health department, CDC) if they are faced with a pediatric patient suspected of having an HHCD. This requires having not only an established screening protocol but also well-established and up-to-date phone trees of "who to call" in the event of a patient with a suspected HHCD.

Identification of these children with potential exposure to high-risk pathogens can be extremely challenging, particularly in the height of influenza and respiratory virus seasons, when seemingly every child evaluated has symptoms including cough, fever, and/or diarrhea. Hospitals and clinics should use appropriate travel screening algorithms, ideally built into the electronic health record admission process and available at all possible points of entry in pediatric centers, including emergency departments, and ambulatory and inpatient settings. Pediatric-specific triage screening questions should be developed with the help of infectious diseases experts, and these questions should be updated with new outbreaks as needed. It is critical to realize that as the international climate changes, outbreaks and diseases will change as well, and frontline staff will require re-education, making travel screening challenging and requiring flexibility and dedication to training and education. The CDC travel advisory Web site can provide quick assistance if needed in a triage setting: wwwnc.cdc.gov/travel/notices.

Example screening questions include:

- *"In the past 3 weeks, have you or your child traveled outside the US or had close contact with someone who traveled outside the US?"*
- *"Has your child had a fever, rash, diarrhea, or cough?"*
- *"Are there ill family members with these symptoms to whom your child was exposed prior to travel?"*

ISOLATION

Pediatric patients and their caregiver(s) must be promptly isolated if the screen for potential HHCD exposure is positive, and they should be evaluated by appropriate experts to determine whether the child is indeed at risk for an HHCD requiring special isolation. Immediate isolation may require masking the patient and recognizing that the accompanying family members may also be infected. Patients believed to be at significant risk for an HHCD should, when possible, be placed in a negative-pressure ventilation room with their family member/caregiver to limit exposure to other patients and staff.

Although limited data exist on triage and isolation of patients with HHCDs, lessons can be

learned from examining previous outbreaks, including the 2003 SARS outbreak, the ongoing MERS outbreak, and the Ebola outbreak from 2014-2015. For example, triage and isolation data from the SARS outbreak from China and Toronto show that in larger outbreaks, it may not be feasible to isolate patients in the few rooms available in small hospital emergency departments, and in these cases, entire floors of hospitals were evacuated and dedicated as SARS triage wards to prevent the nosocomial spread of the virus. Additionally, a dedicated team of clinicians was assigned to evaluate patients presenting with these symptoms to limit the spread of the virus.

Although it may not be feasible in many institutions, it may be wise to consider a safe and effective isolation and triage plan in advance, which does work. This may involve designating a set of rooms that can be isolated from the remaining rooms, and care providers for these patients, or discussing with key stakeholders how patients would be transferred to other wards or facilities to make room for isolation patients. Regardless, these plans should be developed and practiced (simulated) in advance.

When a patient does present with a suspected HHCD, only a single nurse and attending physician should assess the patient, and contact should be limited. Ideally, learners should be limited from seeing high-risk patients. Once a patient has been identified, isolated, and assessed, internal and external stakeholders must be promptly informed to facilitate testing and, if needed, transport specimens and/or the patient. The challenges and potentially solutions are outlined in **Table 2: Preparedness Steps for a Child with a Suspected EID: Identify, Isolate, and Inform.**

FAMILY INCLUSION

It is important to have a plan in place to screen family members for symptoms to reduce the risk of disease spread. *It must be presumed that if a child is infected with an HHCD, family members are at high risk for exposure as well.* At the same time, it is critical to address the complex social and ethical considerations for family members when dealing with pediatric patients in special isolation, and protocols for how these issues will be handled will vary from institution to institution. The AAP offers guidelines for such issues (“Parental Presence During Treatment of Ebola or Other Highly Consequential Infection,” available at: <http://pediatrics.aappublications.org/content/early/2016/08/18/peds.2016-1891>). Adults will also require screening, evaluation, and potentially specialized treatment at an adult treatment center. For this reason, the local health department should immediately be involved in all suspected cases of HHCDs.

The complex needs of family members of isolated pediatric patients, including family visitation policies, requires advanced planning, and each institution must decide on their own policies *before* facing this situation. Ideally, these plans should be vetted with state/local public health authorities.

These policies can range from a “zero tolerance” visitation policy, in which families are not allowed any contact with the patient while in isolation, to an “all or nothing approach,” in which a caregiver may choose to remain at the patient’s bedside for the entirety of the admission after demonstrating proper technique in both donning and doffing PPE. These decisions should be made in consultation with a team including infectious diseases experts, state and/or local public health authorities, risk management, and the clinical care staff who will be involved in caring for

the child. All decisions should be made with the safety of the staff and community at large in mind, and if the decision is made to allow family visitation, this should be closely observed at all times. The impact of family visitation must also be balanced with the risk it may pose to staff members caring for the patient. The ability of families to follow instructions, including appropriate donning and doffing of PPE, should be carefully considered, and may require a case-by-case evaluation. Lastly, the decision to allow families to visit children in strict isolation may differ depending on the pathogen.

Regardless of institutional policies, it is critical to address the obvious stress these issues will have on family members as well as on staff. Working with professionals such as social workers, child life specialists, chaplains, and behavioral health specialists to develop policies and procedures is key to ensure both families and staff are supported in the best possible manner. Parents should be given information on how to obtain updates 24 hours a day, with a way to easily communicate with the team caring for their child. Establishing a comfortable, secure and private space where a family can find solace is recommended. Additionally, family members should be screened daily for symptoms and isolated immediately if there is suspicion of infection.

Although local health departments should be partners in the screening of family members, it is critical to establish institutional protocols regarding how family will be cared for while their children are patients in special isolation. Protocols should include how family will be entering and exiting the hospital, ensuring families are provided adequate privacy, and monitoring family movements within the hospital to ensure family members who may in fact be contagious are confined to specific, controlled areas. These points are particularly important with respiratory pathogens, for which symptoms may be vague, and patients may be contagious before they are identified.

EMERGING INFECTIOUS DISEASES CONCLUSIONS

Being prepared to safely care for pediatric patients with HHCDs is a necessity for every institution in the United States that provides care for children, as emerging and re-emerging infectious diseases are a constant threat to pediatric health care worldwide. It takes a system-wide dedication to continued training and education; it is only with sufficient preparation and training that safe, high-quality care can be provided to both pediatric patients with HHCDs and their families, while at the same time ensuring the staff dedicated to caring for them, as well as our greater communities, stay safe. This requires that all health care facilities, at all points of entry, be prepared to identify, isolate, inform, and provide care for these vulnerable patients and their families. Steps to help facilities prepare and relevant resources are included in Tables 5.3 and 5.4.

Table 5.3: The Basic Steps in Preparing for Highly Infectious Patients
1. Develop an institutional personal protective equipment (PPE) plan in which frontline providers are consistently trained (ER, clinics, ICUs).
2. Develop a consistent screening plan feasible for your institution at the triage level.
3. Develop a plan on how patients of concern will be rapidly isolated for each frontline facility (emergency departments, clinics, etc): identify a room and a general protocol.
4. Develop a phone tree: include leadership, consults/specialists, and local health department contacts. Keep this up-to-date.
5. Know where to find up-to-date information, and keep this material available for frontline staff (Table 4: Where to Find Up-To-Date Information).
6. Identify your local and state partners, including Ebola assessment and treatment centers (www.cdc.gov/vhf/ebola/healthcare-us/preparing/current-treatment-centers.html).
7. Develop a plan for highly biohazardous waste now. Where will the waste be safely stored until it can be removed? (www.cdc.gov/vhf/ebola/healthcare-us/cleaning/handling-waste.html)
8. PRACTICE these plans: quarterly training recommended, twice yearly at minimum.

Table 5.4: Where to Find Up-To-Date Information
CDC Emerging Infectious Diseases and Travel Notices: <ul style="list-style-type: none"> • www.cdc.gov/niosh/topics/emerginfectediseases/default.html • wwwnc.cdc.gov/travel/notices
CDC Influenza Web page: <ul style="list-style-type: none"> • www.cdc.gov/flu/
World Health Organization (WHO) Outbreaks and Emergencies: <ul style="list-style-type: none"> • www.who.int/en/
National Ebola Training and Education Center: <ul style="list-style-type: none"> • https://netec.org
American Academy of Pediatrics: <ul style="list-style-type: none"> • www.aap.org
The Society for Healthcare Epidemiology of America: <ul style="list-style-type: none"> • www.shea-online.org
Infectious Disease Society of America: <ul style="list-style-type: none"> • www.idsociety.org/Index.aspx
AAP Red Book: Report of the Committee on Infectious Diseases: <ul style="list-style-type: none"> • https://redbook.solutions.aap.org/redbook.aspx

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