

AMERICAN ACADEMY OF PEDIATRICS
PEDIATRIC DISASTER PREPAREDNESS AND RESPONSE
TOPICAL COLLECTION
CHAPTER 1: HOW CHILDREN ARE DIFFERENT

January 2019

EDITORS

Sarita Chung, MD, FAAP
George Foltin, MD, FAAP
David J. Schonfeld, MD, FAAP

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®



Published by the American Academy of Pediatrics
345 Park Boulevard
Itasca, IL 60143

Telephone: 630-626-6000

Facsimile: 847-434-8000

www.aap.org

www.healthychildren.org

www.aap.org/disaster/manual

The recommendations in this publication do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Listing of resources does not imply an endorsement by the American Academy of Pediatrics (AAP). The AAP is not responsible for the content of external resources. Information was current at the time of publication.

Products and Web sites are mentioned for informational purposes only and do not imply an endorsement by the AAP. Web site addresses are as current as possible but may change at any time.

Brand names are furnished for identification purposes only. No endorsement of the manufacturers or products mentioned is implied.

The publishers have made every effort to trace the copyright holders for borrowed materials. If they have inadvertently overlooked any, they will be pleased to make the necessary arrangements at the first opportunity.

This publication has been developed by the AAP. The contributors are expert authorities in the field of pediatrics. No commercial involvement of any kind has been solicited or accepted in development of the content of this publication.

Every effort is made to keep the *Pediatric Disaster Preparedness and Response Topical Collection* consistent with the most recent advice and information available from the AAP.

© 2019 American Academy of Pediatrics

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without prior permission from the publisher (locate title at <http://ebooks.aappublications.org> and click on © Get permissions; you may also fax the permissions editor at 847/434-8780 or e-mail permissions@aap.org). For additional information, contact the AAP staff at DisasterReady@aap.org.

CHAPTER ONE: HOW CHILDREN ARE DIFFERENT

As all pediatric care providers know, one cannot treat children as small adults. Children have many unique anatomic, physiologic, immunologic, developmental, and psychologic considerations that potentially affect their vulnerability to injury and response in a disaster. Pediatricians can and should ensure that the needs of children are met in triage, diagnosis, and management in times of catastrophic occurrences.

ANATOMIC DIFFERENCES

Size

A smaller body has smaller circulating blood volume and less fluid reserve. Volumes of blood loss that would be easily handled by an adult can produce hemorrhagic shock in children. Therefore, infections that might cause mild symptoms of vomiting and diarrhea in adults could lead to hypovolemic dehydration and shock in infants, small children, or children and youth with special health care needs. These are urgent emergency situations that can very quickly lead to organ failure or death.

A child's smaller mass means greater force applied per unit of body area. The energy imparted from flying objects, falls, or other blunt or blast trauma is transmitted to a body with less fat, less elastic connective tissue, and closer proximity of chest and abdominal organs. The result is a higher frequency of multiple-organ injury.

A child's small size makes him or her more vulnerable to exposure and toxicity from agents that are heavier than air such as sarin gas and chlorine. These agents accumulate close to the ground in the breathing zone of infants, toddlers, and children.

Structure

Head injury is common in children. The head is a larger, heavier portion of a child's body compared with the head of an adult. A child's head is supported by a short neck that lacks well-developed musculature. The calvarium (skullcap) is thin and vulnerable to penetrating injury, thus allowing greater transmission of force to the growing brain of a child.

The pediatric cervical spine is subject to distracting forces that are more likely to disrupt the upper cervical vertebra and ligaments; however, interpretation of diagnostic imaging is potentially confusing, and children can have spinal cord injury without radiographic abnormality.

The child's skeleton is more pliable than that of adults, and it is incompletely calcified with active growth centers that are more susceptible to fracture. Orthopedic injuries with subtle symptoms and physical findings are easily missed, especially in preverbal children.

Internal organ damage can occur without overlying bony fracture. It is common to have serious cardiac or lung injuries without having incurred rib fractures. The thoracic cage of a child does not provide as much protection of upper abdominal organs as that of an adult. Hepatic or splenic

injuries from blunt trauma can go unrecognized and produce significant blood loss leading to hypovolemic shock.

The mediastinum is very mobile in children. Subsequently, a tension pneumothorax can become quickly life-threatening when the mediastinum is forced to the opposite side compromising venous return and cardiac function.

Body Surface Area

The ratio of body surface area (BSA) to mass is highest at birth and gradually diminishes as the child matures. The distribution of BSA also differs between children and adults. Children have a higher percentage of BSA devoted to the head relative to the lower extremities, and this must be taken into account when determining the percentage of BSA involved for burn injuries and in situations of hypothermia treatment or prevention.

PHYSIOLOGIC DIFFERENCES

Children can compensate and maintain heart rate during the early phases of hypovolemic shock, which creates a false impression of normalcy resulting in resuscitation with too little fluid administration. This can be followed by a swift deterioration with little warning.

Pediatric care providers must be able to quickly interpret whether a child's vital signs are normal or abnormal for age. Temperature is an often forgotten but important vital sign in injured children. The child's ability to control body temperature is affected not only by BSA-to-mass ratio but also by thin skin and lack of substantial subcutaneous tissue. These factors increase evaporative heat loss and caloric expenditure. Considerations of methods to maintain and restore normal body temperature are critical to the resuscitation of children. Supportive methods can include thermal blankets and *warmed* resuscitation rooms, intravenous fluids, and inhaled gases.

Children have a higher minute ventilation than adults, which means that over the same period of time, they are exposed to relatively larger doses of aerosolized biological and chemical agents than are adults. The result is that children suffer the effects of these agents much more rapidly. Children are also more likely to absorb more of the substance from the lungs before it is cleared or diffused through ventilation.

IMMUNOLOGIC DIFFERENCES

Children have immature immunologic systems, placing them at higher risk of infection. Immunologically, children have less herd immunity from infections and a unique susceptibility to many infectious agents.

DEVELOPMENTAL DIFFERENCES

Children rely on parents or other adult caregivers for food, clothing, and shelter. In disasters, these caregivers can be injured, killed in the incident, or not present. Children, especially infants and toddlers:

- Are limited in their verbal ability to communicate their wants and needs;
- Do not always have the motor skills needed to escape from the site of the incident;
- May be limited in their ability to figure out how to flee from danger or to follow directions from others; or

- May not even recognize a threat, and because of their curious nature, may move toward a risky situation.

PSYCHOLOGICAL DIFFERENCES

The psychological effects of disaster on children are neither uniform nor universal in nature (see the section on mental health).

BIBLIOGRAPHY

Bachrach LK. Bare-bones fact – children are not small adults. *New Engl J Med*. 2004;351(9):924-926

Centers for Disease Control and Prevention. How are children different from adults? Available at: www.cdc.gov/childrenindisasters/differences.html. Updated February 11, 2015. Accessed September 4, 2018

Peck GQ. The youngest victims: disaster preparedness to meet children's needs. *Pediatr Rev*. 2008;29(11):Appendix