5TH EDITION

Maternity and Pediatric Nursing

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This book is dedicated to the love of my life, my husband, Glenn, who fortifies me and encourages me in all my endeavors. Appreciate your support, encouragement, and expertise in editing. You are my rock and I am so blessed to have you at my side. And also to my children, Brian and Jennifer, and my grandchildren—Alyssa, Leyton, Sandon, Peyton, Wyatt, Michael, Rylan, Brody, Veda, and Reese—who bring me life's greatest joys. You make it all worthwhile.

—SUSAN SCOTT RICCI

This text is dedicated to all of the children and families I have been so honored to care for as a pediatric nurse and pediatric nurse practitioner. Thank you to my forever supportive husband, John, my amazing and delightful children, Christian and Caitlin, and the loves of my life: granddaughters Sophia and Chloe.

—TERRI KYLE

This book is dedicated to all the children out there and the wonderful nurses who care for them. They inspire me to become a better nurse, educator, and person. It is the major impact nurses have on the health of children and their families that drives me to find the best methods of teaching clinical judgment; our children deserve only the best pediatric nurses, with thorough education and training. This book is also dedicated to my loving and supportive family. My husband, Chris, without whom I could not have reached this accomplishment. My four beautiful girls, Grace, Ella, Lily, and Maya, who have allowed me to learn firsthand about growth and development and who truly amaze me each and every day. My parents, Lene and Kishor Patel, who always taught me I could do whatever I put my mind to. To Terri Kyle, thank you for this opportunity, your endless support, and your incredible vision.

—SUSAN CARMAN

ABOUT THE AUTHORS

SUSAN SCOTT RICCI

Susan Scott Ricci earned a diploma in nursing from the Washington Hospital Center School of Nursing with a BSN and an MSN from the Catholic University of America located in Washington, DC, as well as an MEd in Counseling from the University of Southern Mississippi. She is licensed as a women's health nurse practitioner (APRN) by the University of Florida. She recently renewed her national certification as a certified nurse educator (CNE). She has worked in numerous women's health care settings including labor and birth, postpartum, prenatal, and family planning ambulatory care clinics. Susan has spent more than 30 years in practice and in nursing education teaching in LPN, ADN, and BSN programs. She is involved in several professional nursing organizations and holds memberships in Sigma Theta Tau International Honor Society of Nursing, Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), American Nurses Association (ANA), National Association of OB/GYN Nurses, Who's Who in Professional Nursing, American Nurses Association, and the Florida Council of Maternal–Child Nurses.

With Susan's wealth of practical and educational experience, it is essential to concentrate on evidence-based nursing practice and reduce the amount of "nice to know" information that is presented to students. As an educator, she recognizes the tendency for nursing educators to want to "cover the world" when teaching, rather than focusing on the facts that students need to know for safe practice. With this mission in mind, Susan has directed her energy to the birth of these essential facts in this textbook.

She recognizes that nursing school instructional time is reduced, as the world of health care is expanding exponentially. Therefore, with the valuable instructional time allotted, she has recognized the urgent need to present pertinent facts as concisely as possible to promote application of knowledge within nursing practice.

TERRI KYLE

Terri Kyle earned a Bachelor of Science in Nursing from the University of North Carolina at Chapel Hill and a Master of Science in Nursing from Emory University in Atlanta, Georgia. Terri received her Doctorate of Nursing Practice in Educational Leadership from American Sentinel University. She is a certified pediatric nurse practitioner and certified nurse educator. Practicing pediatric nursing for over 40 years, Terri has had the opportunity to serve children and their families in a variety of diverse settings.

She has experience in inpatient pediatrics in pediatric and neonatal intensive care units, newborn nursery, specialized pediatric units, and community hospitals. She has worked as a pediatric nurse practitioner in pediatric specialty clinics and primary care. She has been involved in teaching nursing for over 32 years with experience in both undergraduate and graduate nursing education. Terri delights in providing innovative leadership to nursing educators and their students. She is a fellow in the National Association of Pediatric Nurse Practitioners and a member of Sigma Theta Tau International Honor Society of Nursing, the National League for Nursing, and the Society of Pediatric Nurses.

SUSAN CARMAN

Susan Carman earned a Bachelor of Science in Nursing from the University of Wisconsin–Madison and a Master of Science in Nursing and Master in Business Administration from the University of Colorado–Denver. As a pediatric nurse for over 25 years, Susan has had the opportunity to care for children in a variety of diverse settings and in many of the major children's hospitals throughout the United States. She also has provided volunteer nursing care in a variety of settings including the Dominican Republic and India. She has been involved in teaching nursing for the past 20 years and enjoys watching students transform into competent nurses with strong clinical judgment.

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PREFACE

Many nursing curricula combine and teach maternity and pediatrics in tandem. This can be viewed as a *natural fit* of two content areas that belong together. Nursing education in general is founded upon the principle of mastering simpler concepts first and incorporating those concepts into the student's knowledge base. The student is then able to progress to problem solving in more complex situations. In today's education climate with reduced class time devoted to specialty courses, it is particularly important for nursing educators to focus on key concepts, rather than attempting to cover everything within a specific topic.

The intent of *Maternity and Pediatric Nursing* is to provide the nurse the basis needed for sound nursing care of women and children. The content in the book will enable the reader to guide women and children toward higher levels of wellness throughout the life cycle. In addition, the focus of the textbook will allow the reader to anticipate, identify, and address common problems and provide timely, evidence-based interventions to reduce long-term sequelae.

This textbook is designed as a practical approach to understanding the health of women and children. The main objective is to help the student build a strong knowledge base and assist with the development of critical thinking skills and clinical reasoning. Women in our society are becoming empowered to make informed and responsible choices regarding their health and that of their children, but to do so they need the encouragement and support of nurses who care for them. This textbook focuses on women and children throughout their lifespan, covering a broad scope of topics with emphasis placed upon common issues. Maternity nursing content coverage is comprehensive yet presented in a concise and straightforward manner. The pediatric nursing content presents the important differences when caring for children compared with caring for adults. Utilizing the nursing process, a concept-based approach to the care of children and their families provides relevant information in a concise and nonredundant manner.

Since women's health has expanded to include care throughout their lifespan, the emphasis of this textbook is on promoting and maintaining their health. The focus of this fifth edition has now expanded to the global outreach of various cultures and traditions that nurses will encounter in their daily practice settings. Nurses are key players in the global community who improve the lives of mothers and infants. Safe nursing practice requires skills and knowledge, with application of sound evidence-based clinical judgment. It is vital for nurses to understand their clients to help promote an optimal outcome to all women and their families. Childbirth today has returned to a more natural practice that honors the normal process of birth. Several chapters focus on physiologic births and the nurse's role to accomplish this. With these imperatives in mind, the chapters present an overview of common health conditions encountered by many women and how to care for them. The new content presented can be used as a framework in caring for clients from diverse backgrounds, histories, and cultures.

The focus when caring for children is also to maintain and promote their health, as well as provide developmentally appropriate care whether the child is well or ill. Restoration of a child's health when an illness is experienced is paramount for timely accomplishment of suitable growth and development. Nurses are in a prime position for influencing children's health, not only through the direct care they provide to children but also through the connections they make with caregivers and their ability to educate families to best care for their children. Focusing on conceptual learning, students may develop complex critical thinking leading to the ability to clinically reason within various health care environments. This approach is supported by many of the book's features, such as the reoccurring features: Unfolding Case Studies, Clinical Reasoning Alerts, and Thinking About Development.

ORGANIZATION

Each chapter of *Maternity and Pediatric Nursing* focuses on a different aspect of maternity and/or pediatric nursing care. The book is divided into 11 units, beginning with general concepts related to maternity and pediatric nursing care, progressing from women's health, pregnancy and birth, through to child health promotion and nursing management of alterations in children's health.

Unit I: Introduction to Maternity and Pediatric Nursing

Unit I helps build a foundation for the student beginning the study of the care of women, infants, and children. This unit explores contemporary issues and trends in maternity and pediatric nursing. Perspectives on female health and pediatric nursing, core concepts of maternal and pediatric nursing, including family-centered and atraumatic care, and communication, and community-based nursing are addressed.

Unit II: Women's Health Throughout the Lifespan

Unit II introduces the student to selected female health topics, including structure and function of the reproductive system, common reproductive concerns, sexually transmitted infections, problems of the breast, and benign disorders and cancers of the female reproductive tract. This unit encourages the student to assist female patients in maintaining their quality of life, reducing their risk of disease, and becoming active partners with their health care professional.

Unit III: Pregnancy

Unit III addresses topics related to normal pregnancy, including fetal development, genetics, and maternal adaptation to pregnancy. Nursing management during normal pregnancy is addressed, encouraging application of basic knowledge to nursing practice. Nursing management includes maternal and fetal assessment throughout pregnancy, interventions to promote self-care and minimize common discomforts, and patient education.

Unit IV: Labor and Birth

Unit IV begins with an explanation of the normal labor and birth process, including maternal and fetal adaptations. This is followed by content focusing on the nurse's role during normal labor and birth, which includes maternal and fetal assessment, pharmacologic and nonpharmacologic comfort measures and pain management, and specific nursing interventions during each stage of labor and birth.

Unit V: Postpartum Period

Unit V focuses on maternal adaptation during the normal postpartum period. Both physiologic and psychological aspects are explored. Paternal adaptation is also considered. This unit also presents related nursing management, including assessment of physical and emotional status, promoting comfort, assisting with elimination, counseling about sexuality and contraception, promoting nutrition, promoting family adaptation, and preparing for discharge.

Unit VI: The Newborn

Unit VI covers physiologic and behavioral adaptations of the normal newborn. It also delves into nursing management of the normal newborn, including immediate assessment and specific interventions as well as ongoing assessment, physical examination, and specific interventions during the early newborn period.

Unit VII: Childbearing at Risk

Unit VII shifts the focus to at-risk pregnancy, childbirth, and postpartum care. Preexisting conditions of the woman, pregnancy-related complications, at-risk labor, emergencies associated with labor and birth, and medical conditions and complications affecting the postpartum woman are all covered. Treatment and nursing management are presented for each medical condition. This organization allows the student to build on a solid foundation of normal material when studying the at-risk content.

Unit VIII: The Newborn at Risk

Unit VIII continues to center on at-risk content. Issues of the newborn with birthweight variations, gestational age variations, congenital conditions, and acquired disorders are explored. Treatment and nursing management are presented for each medical condition. This organization helps cement the student's understanding of the material.

Unit IX: Health Promotion of the Growing Child and Family

Unit IX provides information related to growth and development expectations of the well child from newborn through adolescence. Although not exhaustive in nature, this unit provides a broad knowledge base related to normal growth and development that the nurse can draw on in any situation. Common concerns related to growth and development and client/family education are included in each age-specific chapter.

Unit X: Foundations of Pediatric Nursing

Unit X covers broad concepts that provide the foundation for providing nursing care for children. Rather than reiterating all aspects of nursing care, the unit focuses on specific details needed to provide nursing care for children in general. The content remains focused upon differences in caring for children compared with adults. Topics covered in this unit include atraumatic care, anticipatory guidance, routine well-child care (including immunization and safety), health assessment, nursing care of the child in diverse settings, including the hospital and at home, concerns common to special needs children, pediatric variations in medication and intravenous fluid delivery and nutritional support, and pain management in children.

Unit XI: Nursing Care of the Child With a Health Disorder

Unit XI focuses on children's responses to health disorders. This unit provides comprehensive coverage of illnesses affecting children and is presented according to broad topics of disorders organized with a body systems approach. It also includes infectious, genetic, and mental health disorders as well as pediatric emergencies. Each

chapter follows a similar format in order to facilitate presentation of the information as well as reduce repetition. The chapters begin with a nursing process overview for the particular broad topic, presenting differences in children and how the nursing process applies. The approach provides a general framework for addressing disorders within the chapter. Individual disorders are then addressed with attention to specifics related to pathophysiology, nursing assessment, nursing management, and special considerations. Common pediatric disorders are covered in greater depth than less common disorders. The format of the chapters allows for the building of a strong knowledge base and encourages critical thinking. Additionally, the format is nursing process driven and consistent from chapter to chapter, providing a practical and sensible presentation of the information.

RECURRING FEATURES

To provide the instructor and student with an exciting and user-friendly text, a number of recurring features have been developed.

Key Terms

A list of terms that are considered essential to the chapter's understanding is presented at the beginning of each chapter. Each key term appears in boldface, with the definition included in the text. Phonetic spellings are provided for terms that may be new or difficult to pronounce.

Learning Objectives

Learning Objectives included at the beginning of each chapter guide the student in understanding what is important and why, leading the student to prioritize information for learning. These valuable learning tools also provide opportunities for self-testing or instructor evaluation of student knowledge and ability.

Words of Wisdom

Each chapter opens with inspiring Words of Wisdom (WOW), which offer helpful, timely, and interesting thoughts. These WOW statements set the stage for each chapter and give the student valuable insight into nursing care of women, children, and their families.

Threaded Case Studies

Real-life scenarios present relevant information regarding women, children, and families that is intended to improve the student's clinical reasoning skills. Questions that are threaded throughout the chapter about the scenario provide an opportunity for the student to critically evaluate the appropriate course of action.

Clinical Reasoning Alert

The Clinical Reasoning Alert promotes critical thinking in the nursing process on information key to clinical reasoning.

Unfolding Patient Stories

Unfolding Patient Stories, written by the National League for Nursing, are an engaging way to begin meaningful conversations in the classroom. These vignettes feature patients from Wolters Kluwer's *vSim for Nursing | Health Assessment* (codeveloped with Laerdal Medical) and DocuCare products; however, each Unfolding Patient Story in the book stands alone, not requiring purchase of these products. For your convenience, a list of these case studies, along with their location in the book, appears in the "Cases That Unfold Across Chapters" section later in this front matter.

Evidence-Based Practice

The consistent promotion of evidence-based practice is a key feature of the text. Throughout the chapters, pivotal questions addressed by current research have been incorporated into Evidence-Based Practice displays, which discuss recent evidence-based research findings and provide recommendations for nurses.

Healthy People 2030

Throughout the textbook, relevant Healthy People 2030 objectives are outlined in box format. The nursing implications or guidance provided in the box serves as a road map for improving the health of women, mothers, and children. These objectives reflect the Healthy People 2030 objectives.

Atraumatic Care

These highlights, located throughout the pediatric sections of the book, provide tips for providing atraumatic care to children in particular situations in relation to the topic being discussed.

Thinking About Development

The content featured in these boxes in chapters related to the care of children will encourage the student to think critically about special developmental concerns relating to the topic being discussed.

Teaching Guidelines

An important tool for achieving health promotion and disease prevention is health education. Throughout the textbook, Teaching Guidelines raise awareness, provide timely and accurate information, and are designed to

ensure the student's preparation for educating women, children, and their families about various issues.

Consider This!

In every chapter the student is asked to *Consider This!* These first-person narratives engage the student in real-life scenarios experienced by their clients. The personal accounts evoke empathy and help the student to perfect caregiving skills. Each box ends with an opportunity for further contemplation, encouraging the student to think critically about the scenario.

Take Note!

The *Take Note!* feature draws the student's attention to points of critical emphasis throughout the chapter. This feature is often used to stress vitally important information.

Drug Guides

Drug guide tables summarize information about commonly used medications. The actions, indications, and significant nursing implications presented assist the student in providing optimum care to women, children, and their families.

Common Laboratory and Diagnostic Tests

The Common Laboratory and Diagnostic Tests tables in many of the chapters provide the student with a general understanding of how a broad range of disorders is diagnosed. Rather than reading the information repeatedly throughout the narrative, the student is then able to refer to the table as needed.

Common Medical Treatments

The Common Medical Treatments tables in many of the nursing management chapters provide the student with a broad awareness of how a common group of disorders is treated either medically or surgically. The tables serve as a reference point for common medical treatments.

Clinical Judgment and the Nursing Process

The Clinical Judgment & Nursing Process boxes provide concrete examples of particular steps of the nursing process and are provided in numerous chapters. Found within the nursing process overview section of the chapter, they summarize issue- or system-related content and outline a guide for delivering care.

Comparison Charts

These charts compare two or more disorders or other easily confused concepts. They serve to provide an explanation that clarifies the concepts for the student.

Nursing Procedures

Step-by-step Nursing Procedures are presented in a clear, concise format to facilitate competent performance of relevant procedures as well as to clarify maternity and pediatric variations when appropriate.

Dosage Calculation Box

This box provides a dosage calculation example in each of the pediatric alteration/disorder chapters. Reiteration of the significance of accurate dosage calculation assists the student with mastery of this critical concept.

Concept Mastery Alerts

Concept Mastery Alerts clarify maternity and pediatric nursing concepts to improve the reader's understanding of potentially confusing topics as identified by Misconception Alerts in Lippincott's Adaptive Learning Powered by PrepU. Data from thousands of actual students using this program in courses across the United States identified common misconceptions for the authors to clarify in this new edition.

Tables, Boxes, Illustrations, and Photographs

Abundant tables and boxes summarize key content throughout the book. Additionally, beautiful illustrations and photographs help the student to visualize the content. These features allow the student to quickly and easily access information.

Key Concepts

At the end of each chapter, Key Concepts provide a quick review of essential chapter elements. These bulleted lists help the student focus on the important aspects of the chapter.

References

References used in the development of the text are provided at the end of each chapter. These listings enable the student to further explore topics of interest. Many online resources are provided as a means for the student to electronically explore relevant content material. These

resources can be shared with women, children, and their families to enhance patient education and support.

Developing Clinical Judgment

This section located at the end of each chapter assists the student with the development of clinical judgment through:

- **Practicing for NCLEX**—these NCLEX-RN style questions (multiple choice, multiple response, fill in the blanks) test the student's ability to utilize critical thinking in the application of the nursing process to chapter material. The questions are styled similarly to the national licensing exam (NCLEX-RN). Next-Gen NCLEX-RN style questions are now included in most chapters.
- **Dosage calculation questions**—these applicable problems test the student's ability to accurately determine medication dosages particular to children.
- **Critical thinking exercises**—these exercises serve to stimulate the student to incorporate the current material with previously learned concepts and reach a satisfactory conclusion. The exercises encourage students to think critically, problem solve, and consider their own perspective on given topics.
- **Study activities**—these activities promote student participation in the learning process. This section encourages increased interaction/learning via clinical, online, and community activities.
- **Answers**—answers to the Developing Clinical Judgment questions are provided to instructors on thePoint®.

INCLUSIVE LANGUAGE

A note about the language used in this book: Wolters Kluwer recognizes that people have a diverse range of identities, and we are committed to using the most inclusive, nonbiased language possible in our products. In line with the principles of nursing, we strive not to define people by their diagnoses, but to recognize their personhood first and foremost, using as much as possible the language diverse groups use to define themselves, and including only information that is relevant to nursing care.

We strive to better address the unique perspectives, complex challenges, and lived experiences of diverse populations traditionally underrepresented in health literature. When describing or referencing populations discussed in research studies, we will adhere to the identities presented in those studies to maintain fidelity to the evidence presented by the study investigators. We follow best practices of language set forth by the *Publication Manual of the American Psychological Association*, 7th edition, but acknowledge that language evolves rapidly, and we anticipate continuing to modify our language in future editions of our products.

TEACHING–LEARNING PACKAGE

Instructor's Resources

Tools to assist you with teaching your course are available upon adoption of this text.

- The **E-Book** gives you access to the book's full text and images online.
- A **Test Generator** features hundreds of questions within a powerful tool to help the instructor create quizzes and tests.
- **PowerPoint presentations** with **Guided Lecture Notes** provide an easy way for you to integrate the textbook with our students' classroom experience, either via slide shows or handouts. Multiple choice and true/false questions are integrated into the presentations to promote class participation and allow you to use iClicker technology.
- An **Image Bank** lets you use the photographs and illustrations from this textbook in your PowerPoint slides or as you see fit in your course.
- **Case Studies** with related questions (and suggested answers) give students an opportunity to apply their knowledge to a client case similar to one they might encounter in practice.
- **Journal Articles**, updated for the new edition, offer access to current research available in Lippincott Williams & Wilkins journals.
- **Multimedia Resources** appeal to a variety of learning styles, including:
  - **Watch and Learn Videos** highlight growth and development, communicating with children, and providing nursing care to the child in the hospital.
  - **Concepts in Action Animations** bring physiologic and pathophysiologic concepts to life and enhance student comprehension.
- **Journal Articles** offer access to current research available in Lippincott Williams & Wilkins journals. Contact your sales representative or check out LWW.com/Nursing for more details and ordering information.

Lippincott® CoursePoint+

The same trusted solution, innovation, and unmatched support that you have come to expect from *Lippincott CoursePoint+* is now enhanced with more engaging learning tools and deeper analytics to help prepare students for practice. This powerfully integrated digital learning solution combines learning tools, case studies, virtual simulation, real-time data, and the most trusted nursing education content on the market to make curriculum-wide learning more efficient and to meet students where they're at in their learning. And now, it's easier than ever for instructors and students to use, giving them everything they need for course and curriculum success!

Lippincott CoursePoint+ includes:

- Engaging course content provides a variety of learning tools to engage students of all learning styles.
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- Varying levels of case studies, virtual simulation, and access to Lippincott Advisor help students learn the critical thinking and clinical judgment skills to help them become practice-ready nurses.
- Unparalleled reporting provides in-depth dashboards with several data points to track student progress and help identify strengths and weaknesses.
- Unmatched support includes training coaches, product trainers, and nursing education consultants to help educators and students implement CoursePoint with ease.

CONTENTS IN BRIEF

CONTENTS

CASES THAT UNFOLD ACROSS CHAPTERS

WOW

WORDS OF WISDOM

Similar to adults, children may take breathing easily for granted.

40

Nursing Care of the Child With an Alteration in Gas Exchange/Respiratory Disorder

KEY TERMS

atelectasis (at´ĕ-lek´tă-sis)
atopy
clubbing
coryza (kō-rī´ză)
cyanosis
hypoxemia
hypoxia
infiltrates
oxygenation
pulse oximetry
rales (rahls)
retractions
rhinorrhea (rī´nōr-ē´ă)
stridor
suctioning
tachypnea (tak´ip-nē´ă)
tracheostomy
ventilation
wheezing
work of breathing

LEARNING OBJECTIVES

Upon completion of the chapter, you will be able to:

1. Distinguish between the anatomy and the physiology of the respiratory system in children versus adults.
2. Identify various factors associated with respiratory illness in infants and children.
3. Discuss common laboratory and other diagnostic tests useful in the diagnosis of respiratory conditions.
4. Describe nursing care related to common medications and other treatments used for management and palliation of respiratory conditions.
5. Recognize risk factors associated with various respiratory disorders.
6. Distinguish various respiratory disorders based on their signs and symptoms.
7. Discuss nursing interventions commonly used for respiratory illnesses.
8. Devise an individualized nursing care plan or concept map for the child with a respiratory disorder.
9. Develop child/family teaching plans for the child with a respiratory disorder.
10. Describe the psychosocial impact of chronic respiratory disorders on children.

Alexander Roberts, a 4-month-old, is brought to the clinic by his parent. He has a cold and has been coughing a great deal for 2 days. Today, the infant has had difficulty taking a bottle and is breathing very quickly. The parent says Alexander seems tired.

INTRODUCTION

Gas exchange refers to the process by which oxygen is transported to cells and carbon dioxide is transported from cells (Giddens, 2021). Nurses encounter potential and actual alterations in gas exchange in all types of patients and must detect problems and intervene early to prevent life-threatening complications.

Alterations in gas exchange (respiratory disorders) are the most common causes of illness and hospitalization in children. These illnesses range from mild, nonacute disorders (such as the common cold or sore throat) to serious life-threatening conditions (such as epiglottitis). Chronic disorders, such as allergic rhinitis or asthma, can affect the quality of life, but frequent acute or recurrent infections can also interfere significantly with the well-being of some children.

Children experience numerous respiratory infections. The child's age, socioeconomic status, and general health status can influence both the development of respiratory disorders and the course of the illness. Infants and younger children are more likely to deteriorate quickly from a respiratory illness, and children with chronic disorders such as diabetes, congenital heart disease, sickle cell anemia, cystic fibrosis, and cerebral palsy tend to be more severely affected with respiratory disorders.

In addition, the season of the year can influence the development of respiratory disorders and the course of the illness. For example, certain viruses are more prevalent in the winter, whereas allergen-related respiratory diseases are more prevalent in the spring and fall.

Parents may have difficulty determining the severity of their child's condition and might either seek care very early in the course of the illness (when it is still very mild) or wait, presenting to the health care setting when the child is very ill. Nurses must be familiar with respiratory conditions affecting children so that they can provide guidance and support to families. Difficulty with breathing can be very frightening for both the child and the parents. Nurses must be able to ask questions that can help establish the severity of the child's illness and determine whether the family should seek care at a health care facility.

Since respiratory illnesses account for most pediatric admissions to general hospitals, nurses caring for children need to have expert assessment and intervention skills in this area. Detection of worsening respiratory status early during deterioration allows for timely treatment and the chance to prevent a minor problem from becoming a critical illness. Nurses are also in a unique position to provide education about respiratory illnesses and to promote efforts to prevent these illnesses.

VARIATIONS IN PEDIATRIC ANATOMY AND PHYSIOLOGY

Alterations in gas exchange/respiratory conditions often affect both the upper and the lower respiratory tract, although some affect primarily one or the other. Respiratory dysfunction in children tends to be more severe than in adults, and several differences in the infant's or child's respiratory system account for this increased severity.

Nose

Newborns are preferential nose breathers until at least 4 weeks of age (Smith, D. 2022). The young infant cannot automatically open their mouth to breathe if the nose is obstructed. The nares must be patent for breathing to be successful while feeding. Newborns breathe through their mouths only while crying.

The upper respiratory mucus serves as a cleansing agent, yet newborns produce very little mucus, making them more susceptible to infection. However, the newborn and young infant have very small nasal passages, so when excess mucus is present, airway obstruction is more likely.

Infants are born with maxillary and ethmoid sinuses present. The frontal sinuses (most often associated with sinus infection) and the sphenoid sinuses develop by age 6 to 8 years. Therefore, younger children are less apt to acquire sinus infections compared to adults.

Throat

The tongue of the infant relative to the oropharynx is larger than in adults. Posterior displacement of the tongue can quickly lead to severe airway obstruction. Through early school age, children tend to have enlarged tonsillar and adenoidal tissue even in the absence of illness. This can contribute to an increased incidence of airway obstruction.

Trachea

The airway lumen is smaller in infants and children than in adults. The infant's trachea is approximately 4 mm

wide compared with the width of 20 mm in adults. When edema, mucus, or bronchospasm is present, the capacity for air passage is greatly diminished. A small reduction in the diameter of a child's airway (resulting from the presence of edema or mucus) will result in an exponential increase in resistance to airflow (Fig. 40.1). Increased **work of breathing** (effort or labor associated with respiration) then occurs.

In teenagers and adults, the larynx is cylindrical and fairly uniform in width. In infants and children younger than 10 years old, the cricoid cartilage is underdeveloped, resulting in laryngeal narrowing (Nagler, 2022). Thus, in infants and children, the larynx is funnel shaped. In addition, the larynx and glottis are located higher in the neck, increasing the chance of aspiration of foreign material into the lower airways. Congenital laryngomalacia occurs in some infants and results in the laryngeal structure being weaker than normal, yielding greater collapse on inspiration. Box 40.1 discusses congenital laryngomalacia.

The child's airway is highly compliant, making it quite susceptible to dynamic collapse in the presence of airway obstruction (Nagler, 2022). The muscles supporting the airway are less functional than those in the adult. Children have a large amount of soft tissue surrounding the trachea, and the mucous membranes lining the airway are less securely attached as compared with adults. This increases the risk for airway edema and obstruction. Upper airway obstruction resulting from a foreign body, croup, or epiglottitis can result in tracheal collapse during inspiration.

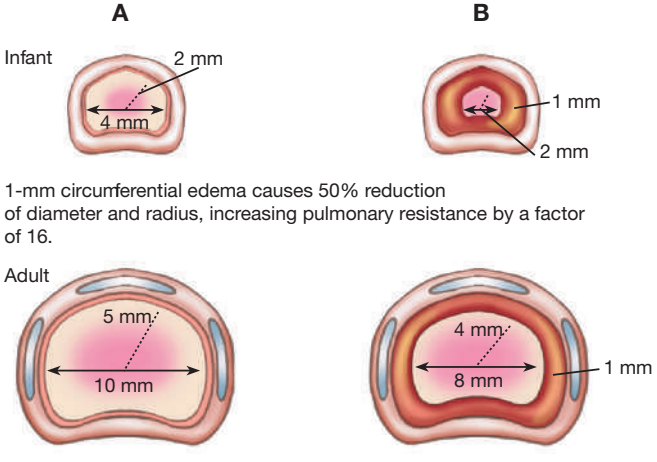


FIGURE 40.1 **A.** Note the smaller diameter of the child's airway under normal circumstances. **B.** With 1 mm of edema present, note the exponential decrease in airway lumen diameter as compared with the adult.

BOX 40.1 Congenital Laryngomalacia

- Inspiratory stridor is present and is intensified with certain positions.
- Suprasternal retractions may be present, but the infant exhibits no other signs of respiratory distress.
- Congenital laryngomalacia is generally a benign condition that improves as the cartilage in the larynx matures. It usually disappears by age 1 year.
- The crowing noise heard with breathing can make parents very anxious. Reassure parents that the condition will improve with time.
- Parents become very familiar with the "normal" sound their infant makes and are often able to identify intensification or change in the stridor. Airway obstruction may occur earlier in infants with this condition, so intensification of stridor or symptoms of respiratory illness should be evaluated early by the primary provider or nurse practitioner.

Lower Respiratory Structures

The bifurcation of the trachea occurs at the level of the third thoracic vertebra in children, compared to the level of the sixth thoracic vertebra in adults (Nagler, 2022). This anatomic difference is important when suctioning children and when endotracheal intubation is required (see Chapter 51 for further discussion). This difference in placement also contributes to risk of foreign material aspiration. The bronchi and bronchioles of infants and children are narrower in diameter than the adult's, placing them at increased risk for lower airway obstruction (see Fig. 40.1). Lower airway obstruction during exhalation often results from bronchiolitis or asthma or is caused by foreign body aspiration into the lower airway.

Alveoli are developed at approximately 24 weeks' gestation. Term infants are born with about 150 million alveoli. At some point between the age of 3 and 8 years, the child has developed the adult number of alveoli of around 300 million (Moore et al., 2020). Alveoli make up most of the lung tissue and are the major sites for gas exchange. Oxygen moves from the alveolar air to the blood, while carbon dioxide moves from the blood into the alveolar air. Smaller numbers of alveoli, particularly in the premature and/or young infant, place the child at a higher risk of hypoxemia (deficiency in the concentration of oxygen in arterial blood) and carbon dioxide retention.

Chest Wall

In older children and adults, the ribs and sternum support the lungs and help keep them well expanded. The movement of the diaphragm and intercostal muscles alters volume and pressure within the chest cavity, resulting in air movement into the lungs. Infants' chest walls are highly compliant (pliable) and fail to support the lungs

adequately. Functional residual capacity can be greatly reduced if respiratory effort is diminished. This lack of lung support also makes the tidal volume of infants and toddlers almost completely dependent on movement of the diaphragm. If diaphragm movement is impaired (as in states of hyperinflation, such as asthma), the intercostal muscles cannot lift the chest wall, and respiration is further compromised.

Metabolic Rate and Oxygen Need

Children have a significantly higher metabolic rate than adults. Their resting respiratory rates are faster and their demand for oxygen is higher. Adult oxygen consumption is 3 to 4 L/min, while infants consume 6 to 8 L/min. In any situation of respiratory distress, infants and children will develop hypoxemia more rapidly than adults (Weiner, 2022). This may be attributed not only to the child's increased oxygen requirement but also to the effect that certain conditions have on the oxyhemoglobin dissociation curve.

Normal oxygen transport relies on binding of oxygen to hemoglobin in areas of high partial pressure of oxygen (PaO_2) (pulmonary arterial beds) and release of oxygen from hemoglobin when the PaO_2 is low (peripheral tissues). Normally, a PaO_2 of 95 mm Hg results in an oxygen saturation of 97%. A decrease in oxygen saturation results in a disproportionate (much larger) decrease in PaO_2 (Fig. 40.2). Thus, a small decrease in oxygen saturation reflects a larger decrease in PaO_2. Conditions such as alkalosis, hypothermia, hypocarbia, anemia, and fetal hemoglobin cause oxygen to become more tightly bound to hemoglobin, resulting in the curve shifting to the left. Common pediatric conditions such as acidosis, hyperthermia, and hypercarbia cause hemoglobin to decrease its affinity for oxygen, further shifting the curve to the right.

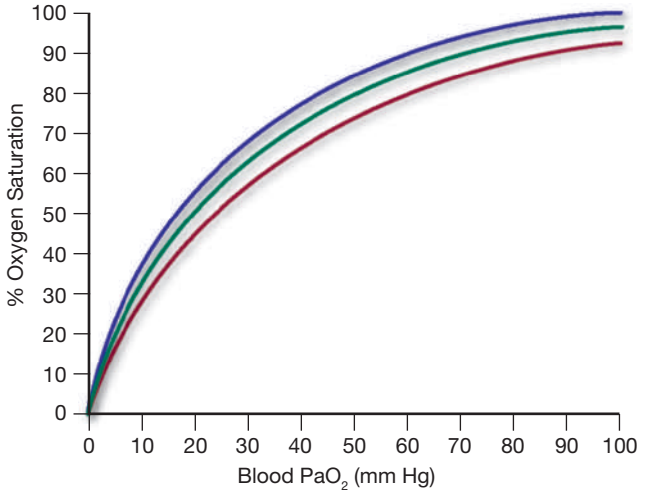


FIGURE 40.2 Normal hemoglobin dissociation curve (green), shift to the right (red), and shift to the left (blue).

COMMON MEDICAL TREATMENTS

A variety of interventions are used to treat respiratory illness in children. The treatments listed in Common Medical Treatments 40.1 and Drug Guide 40.1 usually require a primary provider's or nurse practitioner's order when a child is hospitalized.

COMMON MEDICAL TREATMENTS 40.1 Respiratory Disorders

Treatment	Explanation	Indications	Nursing Implications
Oxygen	Supplemented via mask, nasal cannula, hood, or tent or via endotracheal or nasotracheal tube	Hypoxemia, respiratory distress	Monitor response via work of breathing and pulse oximetry.
High humidity	Addition of moisture to inspired air	Common cold, croup, tonsillectomy	Infant may require extra blankets with cool mist and frequent changes of bedclothes under oxygen hood or tent as they become damp.
Suctioning	Removal of secretions via bulb syringe or suction catheter	Excessive airway secretions (common cold, flu, bronchiolitis, pertussis)	Should be done carefully and only as far as recommended for age or tracheostomy tube size, or until cough or gag occurs
Chest physiotherapy (CPT) and postural drainage	Promotes mucus clearance by mobilizing secretions with the assistance of percussion or vibration accompanied by postural drainage	Bronchiolitis, pneumonia, cystic fibrosis, or other conditions resulting in increased mucus production. Not effective in inflammatory conditions without increased mucus	May be performed by respiratory therapist in some institutions, by nurses in others; in either case, nurses must be familiar with the technique and able to educate families on its use.

COMMON MEDICAL TREATMENTS 40.1 Respiratory Disorders

Treatment	Explanation	Indications	Nursing Implications
Saline gargles	Relieves throat pain via saltwater gargle	Pharyngitis, tonsillitis	Recommended for children old enough to understand the concept of gargling (to avoid choking)
Saline lavage	Normal saline introduced into the airway, followed by suctioning	Common cold, flu, bronchiolitis, any condition resulting in increased mucus production in the upper airway	Very helpful for loosening thick mucus; child may need to be in semi-upright position to avoid aspiration.
Chest tube	Insertion of a drainage tube into the pleural cavity to facilitate removal of air or fluid and allow full lung expansion	Pneumothorax, empyema	Should tube become dislodged from container, the chest tube must be clamped immediately or the open end placed into a container of sterile water to avoid further air entry into the chest cavity.
Bronchoscopy	Introduction of a bronchoscope into the bronchial tree for diagnostic purposes; also allows for bronchiolar lavage	Removal of foreign body, cleansing of bronchial tree	Watch for postprocedure airway swelling, complaints of sore throat.

DRUG GUIDE 40.1

COMMON DRUGS FOR RESPIRATORY DISORDERS

Medication	Actions/Indications	Nursing Implications
Expectorant (guaifenesin)	Reduces viscosity of thickened secretions by increasing respiratory tract fluid Used for the common cold, pneumonia, and other conditions requiring mobilization and subsequent expectoration of mucus	Encourage deep breathing before coughing to mobilize secretions. Maintain adequate fluid intake. Assess breath sounds frequently.
Cough suppressants (dextromethorphan, codeine, hydrocodone)	Relieve irritating, nonproductive cough by direct effect on the cough center in the medulla, which suppresses the cough reflex Used for the common cold, sinusitis, pneumonia, bronchitis	Should be used only with nonproductive coughs in the absence of wheezing
Antihistamines	Treatment of allergic conditions such as allergic rhinitis, asthma	May cause drowsiness or dry mouth
Antibiotics (oral, parenteral)	Treatment of bacterial infections of the respiratory tract such as pharyngitis, tonsillitis, sinusitis, bacterial pneumonia, cystic fibrosis, empyema, abscess, tuberculosis	Check for antibiotic allergies. Should be given as prescribed for the length of time prescribed
Antibiotics (inhaled)	Treatment of bacterial infections of the respiratory tract in children with cystic fibrosis	Can be given via nebulizer
$Beta_2$-Adrenergic agonists (short acting) (i.e., albuterol, levalbuterol, pirbuterol)	Relax airway smooth muscle, resulting in bronchodilation Used for acute and chronic treatment of wheezing and bronchospasm in asthma, bronchiolitis, cystic fibrosis, chronic lung disease; also used to prevent wheezing in exercise-induced asthma	Administered via inhalation Can be used for acute relief of bronchospasm May cause nervousness, tachycardia, and jitteriness Inhaled agents result in fewer systemic side effects.
$Beta_2$-Adrenergic agonists (long acting) (i.e., formoterol, salmeterol)	Long-acting bronchodilator used in chronic asthma management and for prevention of exercise-induced asthma Long-term control in chronic asthma Prevention of exercise-induced asthma	Administered via inhalation Used only for long-term control or for exercise-induced asthma, not for relief of bronchospasm in an acute wheezing episode

(*continued*)

DRUG GUIDE 40.1 (*continued*)

COMMON DRUGS FOR GI DISORDERS

Medication	Actions/Indications	Nursing Implications
Racemic epinephrine	Produces bronchodilation Indicated for croup	Assess lung sounds and work of breathing. Observe for rebound bronchospasm.
Anticholinergic (ipratropium)	Produces bronchodilation in asthma or chronic lung disease	In children, generally used as an adjunct to beta$_2$-adrenergic agonists for treatment of bronchospasm
Antiviral agents (oral: amantadine, rimantadine, oseltamivir: inhaled zanamivir)	Treatment and prevention of influenza A	Amantadine, rimantadine: monitor for confusion, nervousness, and jitteriness Oseltamivir, zanamivir: well tolerated but expensive
Corticosteroids (inhaled) (beclomethasone, budesonide, fluticasone, mometasone)	Exert a potent, locally acting antiinflammatory effect to decrease the frequency and severity of asthma attacks; may also delay pulmonary damage that occurs with chronic asthma; also used for chronic lung disease and croup syndromes	Not for treatment of acute wheezing Rinse mouth after inhalation to decrease incidence of fungal infections, dry mouth, and hoarseness. Minimal systemic absorption makes inhaled steroids the treatment of choice for asthma maintenance program.
Corticosteroids (oral, parenteral) (prednisolone, prednisone)	Suppress inflammation and normal immune response Used for acute asthma exacerbations, wheezing with chronic lung disease, and severe croup	May cause hyperglycemia May suppress reaction to allergy tests Consult primary provider or nurse practitioner if vaccinations are ordered during course of systemic corticosteroid therapy. Short courses of therapy are generally safe. Very effective, but long-term or chronic use can result in peptic ulceration, altered growth, and numerous other side effects. Children on long-term dosing should have growth assessed.
Decongestants (e.g., pseudoephedrine)	Treatment of runny or stuffy nose associated with the common cold, sinusitis, or allergic rhinitis in children older than age 6	Assess child periodically for nasal congestion. Some children react to decongestants with excessive sleepiness or increased activity.
Leukotriene receptor antagonists (montelukast, zafirlukast)	Decrease inflammatory response by antagonizing the effects of leukotrienes to control asthma in children age 1 year and older Montelukast: for allergic rhinitis in children 6 months and older	Given once daily, in the evening Not for relief of bronchospasm during an acute wheezing episode, but may be continued during the episode
Mast cell stabilizers (cromolyn, nedocromil)	Prevent release of histamine from sensitized mast cells, resulting in decreased frequency and intensity of allergic reactions in children with asthma or chronic lung disease; also used as pre-exposure treatment for allergens	Administered via inhalation For prophylactic use, not to relieve bronchospasm during an acute wheezing episode Can be used 10–15 minutes prior to exposure to allergen, to decrease reaction to allergen
Respiratory stimulants (methylxanthines: theophylline, aminophylline, caffeine)	To provide for continuous airway relaxation in moderate or severe asthma to achieve long-term control (methylxanthines)	Administered orally or intravenously; sustained-release oral preparation can be used to prevent nocturnal symptoms. Monitor drug levels routinely. Report signs of toxicity immediately: tachycardia, nausea, vomiting, diarrhea, stomach cramps, anorexia, confusion, headache, restlessness, flushing, increased urination, seizures, arrhythmias, insomnia.
Inhaled pulmonary enzyme (dornase alfa)	Enzyme that hydrolyzes the DNA in sputum, reducing sputum viscosity in children with cystic fibrosis	Administered via nebulizer Monitor for dysphonia and pharyngitis.

Data from UpToDate, Inc. (2024). *Lexi-comp®* (Version 8.1.2) [Mobile app]. Wolters Kluwer Health. https://apps.apple.com/us/app/lexicomp/id313401238.

Clinical Judgment and the Nursing Process

Care of the child with a respiratory disorder includes assessment, nursing analysis, planning, interventions, and evaluation. There are several general concepts related to the nursing process that can be applied to respiratory disorders. From an overall understanding of the care involved for a child with an alteration in gas exchange, the nurse can then individualize the care based on specifics for the particular child.

Assessment

Assessment of respiratory dysfunction in children includes health history, physical examination, and laboratory or diagnostic testing.

Health History

The health history consists of the past medical history, family history, and history of present illness (when the symptoms started and how they have progressed), as well as treatments used at home. Ascertain immunization history. The past medical history might be significant for recurrent colds or sore throats, **atopy** (genetic tendency toward asthma, allergic rhinitis, or atopic dermatitis), prematurity, respiratory dysfunction at birth, poor weight gain, or history of recurrent respiratory illnesses or chronic lung disease. Family history might be significant for chronic respiratory disorders such as asthma or might reveal contacts for infectious exposure. When eliciting the history of the present illness, inquire about onset and progression; fever; nasal congestion; noisy breathing; presence and description of cough; rapid respirations; increased work of breathing; ear, nose, sinus, or throat pain; ear pulling; headache; vomiting with coughing; poor feeding; and lethargy. Also inquire about exposure to secondhand smoke. Children exposed to environmental smoke have an increased incidence of respiratory infections, acute otitis media, and asthma exacerbations (Centers for Disease Control and Prevention [CDC], 2022). See Healthy People 2030 box.

HEALTHY PEOPLE 2030

Objective	Nursing Significance
Reduce the proportion of people exposed to secondhand smoke.	• Educate the family about the effects that passive smoking has on children. • Encourage families to join smoking cessation programs.

Healthy People Objectives retrieved from http://www.healthypeople.gov

Physical Examination

Physical examination of the respiratory system includes inspection and observation, auscultation, percussion, and palpation.

Inspection and Observation

Inspection and observation of the respiratory system includes assessing color, overall appearance, respiratory rate, and hydration status, inspecting the nose and oral cavity as well as the nail beds for clubbing, observing work of breathing, and audibly listening for cough and other airway noises.

Color. Observe the child's skin color, noting pallor or cyanosis (circumoral or central). Pallor (pale appearance) occurs as a result of peripheral vasoconstriction in an effort to conserve oxygen for vital functions. **Cyanosis** (a bluish tinge to the skin and mucous membranes) occurs because of hypoxia (oxygen deficiency). It might first present circumorally (just around the mouth) and progress to central cyanosis. Newborns might have blue hands and feet (acrocyanosis), a normal finding. The infant might have pale hands and feet when cold or when ill, as peripheral circulation is not well developed in early infancy. It is important, then, to note if the cyanosis is central (involving the midline), as this is a true sign of hypoxia. Children with low red blood cell counts might not demonstrate cyanosis as early in the course of hypoxemia as children with normal hemoglobin levels. Therefore, absence of cyanosis or the degree of cyanosis present is not always an accurate indication of the severity of respiratory involvement.

Note the rate and depth of respiration as well as work of breathing. Often, the first sign of respiratory illness in infants and children is **tachypnea** (increased respiratory rate for age).

TAKE NOTE!

A slow or irregular respiratory rate in an acutely ill infant or child is an ominous sign (Weiner, 2022). See Chapter 51.

Nose and Oral Cavity. Inspect the nose and oral cavity. Note nasal drainage and redness or swelling in the nose. Note the color of the pharynx, presence of exudate, tonsil size, and status and presence of lesions anywhere in the oral cavity.

Cough and Other Airway Noises. Note the sound of the cough (Is it wet or productive, dry and hacking, tight? When does the cough occur? Is it only or mainly at night?). Also note if noises associated with breathing are present (e.g., grunting, stridor, or audible wheeze). Grunting occurs on expiration and is produced by premature glottic closure. It is an attempt to preserve or increase functional residual capacity. Grunting might occur with alveolar collapse or loss of lung volume, such as in **atelectasis** (a collapsed or airless portion of

the lung), pneumonia, and pulmonary edema. **Stridor**, a high-pitched, readily audible inspiratory noise, is a sign of upper airway obstruction. Sometimes, wheezes can be heard with the naked ear; these are referred to as audible wheezes.

Respiratory Effort. Assess respiratory effort for depth and quality. Is breathing labored? Infants and children with significant nasal congestion may have tachypnea, which usually resolves when the nose is cleared of mucus. Mouth breathing may occur when a large amount of nasal congestion is present. Increased work of breathing, particularly if associated with restlessness and anxiety, usually indicates lower respiratory involvement. Assess for the presence of nasal flaring, retractions, or bobbing of the head with each breath. Nasal flaring can occur early in the course of respiratory illness and is an effort to inhale greater amounts of oxygen.

Retractions. Retractions (the inward pulling of soft tissues with respiration) can occur in the intercostal, subcostal, substernal, supraclavicular, or suprasternal regions (Fig. 40.3). Document the severity of the retractions: mild, moderate, or severe. Also note the use of accessory neck muscles. Note the presence of paradoxical breathing (lack of simultaneous chest and abdominal rise with the inspiratory phase).

TAKE NOTE!

Seesaw (or paradoxical) respirations are very ineffective for **ventilation** (gas exchange) and **oxygenation** (binding of oxygen). The chest falls on inspiration and rises on expiration.

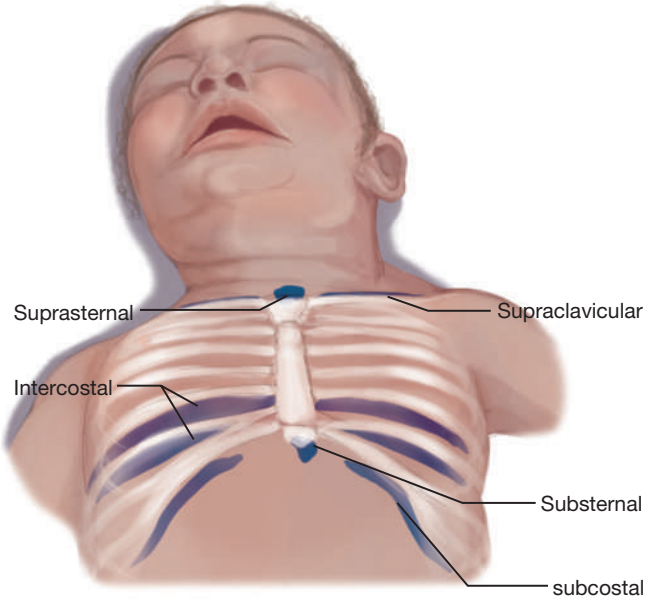


FIGURE 40.3 Location of retractions.

Anxiety and Restlessness. Is the child anxious or restless? Restlessness, irritability, and anxiety result from difficulty in securing adequate oxygen. These might be very early signs of respiratory distress, especially if accompanied by tachypnea. Restlessness might progress to listlessness and lethargy if the respiratory dysfunction is not corrected.

Clubbing. Inspect the fingertips for the presence of **clubbing**, an enlargement of the terminal phalanx of the finger, resulting in a change in the angle of the nail to the fingertip (Fig. 40.4). Clubbing might occur in children with a chronic respiratory illness. It is the result of increased capillary growth as the body attempts to supply more oxygen to distal body cells.

Hydration Status. Note the child's hydration status. Palpate the infant's fontanels to determine if sunken. Assess the oral mucosa for color and moisture. Note skin turgor, presence of tears, and adequacy of urine output. The child with a respiratory illness is at risk for dehydration. Pain related to sore throat or mouth lesions may prevent the child from drinking properly. Nasal congestion interferes with the infant's ability to suck effectively at the breast or bottle. Tachypnea and increased work of breathing interfere with the ability to safely ingest fluids.

Palpation

Palpate the sinuses for tenderness in the older child. Assess for enlargement or tenderness of the lymph nodes of the head and neck. Document alterations in tactile fremitus detected on palpation. Increased tactile fremitus might occur in the case of pneumonia or

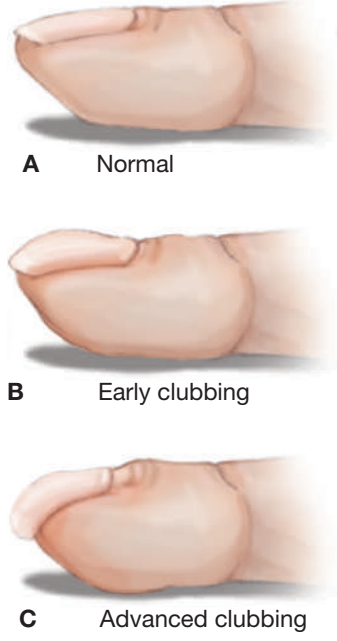


FIGURE 40.4 Normal fingertip **(A)**. Early clubbing **(B)** may progress eventually to advanced clubbing **(C)** because of chronic hypoxemia.

pleural effusion. Fremitus might be decreased in the case of barrel chest, as with cystic fibrosis. Absent fremitus might be noted with pneumothorax or atelectasis.

Compare central and peripheral pulses. Note the quality of the pulse as well as the rate. With significant respiratory distress, perfusion often becomes compromised. Poor perfusion might be reflected in weaker peripheral pulses (radial, pedal) when compared to central pulses.

Percussion

When percussing, note sounds that are not resonant in nature. Flat or dull sounds might be percussed over partially consolidated lung tissue, as in pneumonia. Tympany might be percussed with a pneumothorax. Note the presence of hyperresonance (as might be apparent with asthma).

Auscultation

Assess lung sounds via auscultation. Evaluate breath sounds over the anterior and posterior chest, as well as in the axillary areas. Note the adequacy of aeration. Breath sounds should be equal bilaterally. The intensity and pitch should be equal throughout the lungs; document diminished breath sounds. In the absence of concurrent lower respiratory illness, the breath sounds should be clear throughout all lung fields. During normal respiration, the inspiratory phase is usually softer and longer than the expiratory phase. Prolonged expiration is a sign of bronchial or bronchiolar obstruction. Bronchiolitis, asthma, pulmonary edema, and an intrathoracic foreign body can cause prolonged expiratory phases.

Infants and young children have thin chest walls. When the upper airway is congested (as in a severe cold), the noise produced in the upper airway might be transmitted throughout the lung fields. When upper airway congestion is transmitted to the lung fields, the congested sounding noise heard over the trachea is the same type of noise heard over the lungs but is much louder and more intense. To ascertain if these sounds are truly adventitious lung sounds or if they are transmitted from the upper airway, auscultate again after the child coughs or their nose has been suctioned. Another way to discern the difference is to compare auscultatory findings over the trachea to the lung fields to determine if the abnormal sound is truly from within the lung or is actually a sound transmitted from the upper airway.

Note adventitious sounds heard on auscultation. **Wheezing**, a high-pitched sound that usually occurs on expiration, results from obstruction in the lower trachea or bronchioles. Wheezing that clears with coughing is most likely a result of secretions in the lower trachea. Wheezing resulting from obstruction of the bronchioles, as in bronchiolitis, asthma, chronic lung disease, or cystic fibrosis, does not clear with coughing. **Rales** (crackling sounds) result when the alveoli become fluid filled, such as in pneumonia. Note the location of the adventitious sounds as well as the timing (on inspiration, expiration, or both). Tachycardia might also be present. An increase in heart rate often initially accompanies hypoxemia.

Laboratory and Diagnostic Testing

Common Laboratory and Diagnostic Tests 40.1 explains the laboratory and diagnostic tests most commonly used for a child with a respiratory disorder. The tests can assist the primary provider or nurse practitioner in diagnosing the disorder and/or be used as guidelines in

COMMON LABORATORY AND DIAGNOSTIC TESTS 40.1 Alterations in Oxygenation/Respiratory Disorders

Test	Explanation	Indications	Nursing Implications
Allergy skin testing	Suggested allergen is applied to skin via scratch, pin, or prick. A wheal response indicates allergy to the substance.	Allergic rhinitis, asthma	Antihistamines must be discontinued before testing, as they inhibit the test. Close observation for anaphylaxis is necessary. Epinephrine and emergency equipment should be readily available. Some children react to the skin test almost immediately; others take several minutes.
Arterial blood gases	Invasive method (requires blood sampling) of measuring arterial pH, partial pressure of oxygen and carbon dioxide, and base excess in blood	Usually reserved for severe illness, the intubated child, or suspected carbon dioxide retention	Hold pressure for several minutes after a peripheral arterial stick to avoid bleeding. Radial arterial sticks are common and can be very painful. Note if the child is crying excessively during the blood draw, as this affects the carbon dioxide level.

(*continued*)

COMMON LABORATORY AND DIAGNOSTIC TESTS 40.1 Alterations in Oxygenation/Respiratory Disorders (*continued*)

Test	Explanation	Indications	Nursing Implications
Chest x-ray	X-ray image of the expanded lungs: can show hyperinflation, atelectasis, pneumonia, foreign body, pleural effusion, abnormal heart or lung size	Bronchiolitis, pneumonia, tuberculosis, asthma, cystic fibrosis, bronchopulmonary dysplasia	Children may be afraid of the x-ray equipment. If a parent or familiar adult can accompany the child, often the child is less afraid. If the child is unable or unwilling to hold still for the x-ray, restraint may be necessary. Restraint should be limited to the amount of time needed for the x-ray.
Fluorescent antibody testing	Determines presence of respiratory syncytial virus (RSV), adenovirus, influenza, parainfluenza, or *Chlamydia* in nasopharyngeal secretions	Bronchiolitis, pneumonia	To obtain a nasopharyngeal specimen, instill 1–3 mL of sterile normal saline into one nostril, aspirate the contents using a small sterile bulb syringe, place the contents in sterile container, and immediately send them to the lab.
Fluoroscopy	X-ray examination that uses a fluorescent screen—"real-time" imaging	Identification of masses, abscesses	Requires the child to lie still. Equipment can be frightening. Children may respond to presence of parent or familiar adult.
Gastric washings for AFB (acid-fast bacilli)	Determines presence of AFB in stomach (children often swallow sputum)	Tuberculosis	Nasogastric tube is inserted, and saline is instilled and suctioned out of the stomach to obtain the specimen.
Peak expiratory flow	Measures the maximum flow of air (in L/s) that can be forcefully exhaled in 1 second	Daily use can indicate adequacy of asthma control.	It is important to establish the child's "personal best" by taking twice-daily readings over a 2-week period while well. The average of these is termed "personal best." Charts based on height and age are also available to determine expected peak expiratory flow.
Pulmonary function tests	Measure respiratory flow and lung volumes	Asthma, cystic fibrosis, chronic lung disease	Usually performed by a respiratory therapist trained to do the full spectrum of tests. Spirometry can be obtained by the trained nurse in the outpatient setting.
Pulse oximetry	Noninvasive method of continuously (or intermittently) measuring oxygen saturation	Can be useful in any situation in which a child is experiencing respiratory distress	Probe must be applied correctly to finger, toe, foot, hand, forehead, or ear for the machine to appropriately pick up the pulse and oxygen saturation.
Rapid flu test	Rapid test for detection of influenza A or B	Influenza	Should be done in first 24 hours of illness so that medication administration can begin Have the child gargle with sterile normal saline and then spit into a sterile container. Send immediately to the lab.
Rapid strep test	Instant test for presence of streptococcus A antibody in pharyngeal secretions	Pharyngitis, tonsillitis	Results in 5–10 minutes. Negative tests should be backed up with throat culture.
RAST (radioallergosorbent test)	Measures minute quantities of immunoglobulin E in the blood Carries no risk of anaphylaxis but is not as sensitive as skin testing	Asthma (food allergies)	Blood test that is usually sent out to a reference laboratory
Sinus x-rays, computed tomography (CT), or magnetic resonance imaging (MRI)	Radiologic tests that may show sinus involvement	Sinusitis, recurrent colds	X-ray results are usually received more quickly than CT or MRI results.

COMMON LABORATORY AND DIAGNOSTIC TESTS 40.1 Alterations in Oxygenation/Respiratory Disorders

Test	Explanation	Indications	Nursing Implications
Sputum culture	Bacterial culture of invasive organisms in the sputum	Pneumonia, cystic fibrosis, tuberculosis	Must be true sputum, not mucus from the mouth or nose; child can deep breathe, cough, and spit, or specimen may be obtained via suctioning of the artificial airway.
Sweat chloride test	Collection of sweat on filter paper after stimulation of skin with pilocarpine Measures concentration of chloride in the sweat	Cystic fibrosis	May be difficult to obtain sweat in a young infant.
Throat culture	Bacterial culture (minimum of 24–48 hours required) to determine presence of streptococcus A or other bacteria	Pharyngitis, tonsillitis	Can be obtained on separate swab at same time as rapid strep test to decrease trauma to the child (swab both applicators at once) Do not perform immediately after the child has had medication or something to eat or drink
Tuberculin skin test	Mantoux test (intradermal injection of purified protein derivative)	Tuberculosis, chronic cough	Must be given intradermally; not a valid test if injected incorrectly

Data from Corbett, J. A., & Banks, A. D. (2019). *Laboratory tests and diagnostic procedures with nursing diagnoses* (9th ed.). Pearson Education Inc.; Medtronic. (2024). *Pulse oximetry.* https://www.medtronic.com/covidien/en-us/products/pulse-oximetry.html

determining ongoing treatment. Laboratory or nonnursing personnel obtain some of the tests, while the nurse might obtain others. In either instance, it is important for the nurse to be familiar with how the tests are obtained, what they are used for, and normal versus abnormal results. This knowledge will also be necessary when providing child and family education related to the testing.

Remember Alexander, the 4-month-old with the cold, cough, fatigue, feeding difficulty, and fast breathing? What additional health history and physical examination assessment information should the nurse obtain?

Nursing Analysis

After recognizing and analyzing cues from a thorough assessment, the nurse may identify several patient problems, including:

- Ineffective airway clearance
- Altered breathing pattern
- Altered gas exchange
- Dehydration risk
- Malnutrition risk
- Activity intolerance
- Fear
- Pain
- Altered family functioning
- Caregiver role strain risk
- Knowledge deficiency

After completing an assessment of Alexander, what would your top three patient problems be?

The preceding patient problems provide suggestions for nursing care planning or concept mapping. Suggested interventions with rationales are provided further on. Care planning should be individualized, based on the child's and family's needs. Refer to Chapter 36 for the nursing process for pain management and to Chapter 33 for nursing interventions related to altered family functioning and caregiver role strain risk. Additional information will be included later in the chapter as it relates to nursing management of children with specific disorders, as well as particular nursing interventions for knowledge deficiency.

Nursing Analysis

Ineffective airway clearance related to excessive mucous, exudate in the alveoli, foreign body in airway, or presence of artificial airway as evidenced by adventitious breath sounds, alteration in respiratory pattern or rate, dyspnea, or excessive sputum.

Goal/Outcome

Child will maintain patent airway, free from secretions or obstruction, with easy work of breathing, and respiratory rate within parameters for age.

Maintaining a Patent Airway (interventions with *rationale*)

- Position with airway open (sniffing position if supine) and/or elevate head of bed *to allow for adequate ventilation.*
- Humidify oxygen or room air, and ensure adequate fluid intake (intravenous or oral) *to liquefy secretions for ease in clearance.*

- Suction with bulb syringe or via nasopharyngeal catheter as needed, particularly prior to bottle-feeding, *to promote clearance of secretions.*
- If tachypneic, maintain nothing by mouth (NPO) status *to avoid aspiration.*
- In older child, encourage expectoration of sputum with coughing *to promote airway clearance.*
- Perform chest physiotherapy (CPT) if ordered *to mobilize secretions.*
- Ensure emergency equipment is readily available *to avoid delay should airway become unmaintainable.*

Nursing Analysis

Altered breathing pattern related to respiratory muscle fatigue as evidenced by abnormal breathing pattern, bradypnea, nasal flaring, tachypnea, use of accessory muscles to breathe, dyspnea, or prolonged expiratory phase.

Goal/Outcome

Child will demonstrate effective breathing pattern: respiratory rate within parameters for age, easy work of breathing (absence of retractions, accessory muscle use, grunting, and nasal flaring), or appropriate expiratory phase.

Promoting an Effective Breathing Pattern (interventions with *rationale*)

- Assess respiratory rate, breath sounds, and work of breathing frequently *to ensure progress with treatment and so that deterioration can be noted early.*
- Position for comfort with open airway and room for lung expansion (usually with head of bed elevated). Use pillows or padding if necessary to maintain position *to ensure optimal ventilation via maximum lung expansion.*
- Allow for adequate sleep and rest periods *to conserve energy.*
- Administer antibiotics as ordered: *may be indicated in the case of bacterial respiratory infection.*
- Encourage incentive spirometry and coughing with deep breathing (can be accomplished through play) *to maximize ventilation (play enhances the child's participation).*

Nursing Analysis

Altered gas exchange related to airway plugging, hyperinflation, or atelectasis, as evidenced by abnormal skin color (duskiness or cyanosis), hypoxia, irritability, restlessness, or alterations in arterial blood gases.

Goal/Outcome

Gas exchange will be adequate: pulse oximetry reading on room air is within normal parameters for age, blood gases within normal limits, absence of cyanosis, irritability, restlessness.

Promoting Adequate Gas Exchange (interventions with *rationale*)

- Monitor oxygen saturation via pulse oximetry *to detect alterations in oxygenation.*
- Administer oxygen as ordered *to improve oxygenation.*
- Encourage clearance of secretions via coughing, expectoration, CPT, and suctioning *to improve gas exchange.*
- Administer bronchodilators if ordered (albuterol, levalbuterol, or racemic epinephrine) *to treat bronchospasm and improve gas exchange.*
- Provide frequent contact and support for the child and family *to decrease anxiety, which increases the child's oxygen demands.*
- Assess and monitor mental status (confusion, lethargy, restlessness, combativeness): *hypoxemia can lead to changes in mental status.*

Nursing Analysis

Dehydration risk related to insufficient fluid intake and/or insensible losses via fever, tachypnea, or diaphoresis.

Goal/Outcome

Fluid volume will be maintained: oral mucosa moist and pink, skin turgor elastic, urine output at least 1 to 2 mL/kg/h.

Maintaining Adequate Fluid Volume (interventions with *rationale*)

- Administer intravenous fluids if ordered *to maintain adequate hydration in NPO state.*
- When allowed oral intake, encourage oral fluids. Popsicles, favorite fluids, and games can be used *to promote intake.*
- Assess for signs of *adequate hydration* (flat fontanels, elastic skin turgor, moist mucosa, adequate urine output).
- Monitor intake and output *to identify fluid imbalance.*
- Monitor urine specific gravity, urine and serum electrolytes, blood urea nitrogen, creatinine, and osmolality *to determine fluid status.*

Nursing Analysis

Malnutrition risk factors include insufficient dietary intake.

Goal/Outcome

Child will maintain adequate nutritional intake: weight is gained or maintained. Child consumes adequate diet for age.

Promoting Adequate Nutritional Intake (interventions with *rationale*)

- Weigh on same scale at same time daily *so that measurements are consistent.*
- Perform calorie counts over a 3-day period *to determine whether caloric intake is sufficient.*
- Encourage child to choose higher-calorie, protein-rich foods *to optimize growth potential.*
- Coax young children to eat better by playing games and offering favorite foods *to improve intake.*

Nursing Analysis

Activity intolerance related to imbalance between oxygen supply and demand as evidenced by exertional dyspnea (need for frequent rest while playing), fatigue, or generalized weakness.

Goal/Outcome

Child will resume normal activity level: activity is tolerated without difficulty breathing. Pulse oximetry readings and vital signs are within parameters for age and activity level.

Increasing Activity Tolerance (interventions with *rationale*)

- Provide rest periods balanced with periods of activity, and group nursing activities and visits *to allow for sufficient rest.*
- Provide small, frequent meals *to prevent overtiring (energy is expended while eating).*
- Encourage quiet activities that do not require exertion *to prevent boredom.*
- Allow gradual increase in activity as tolerated, keeping pulse oximetry reading within normal parameters, *to minimize risk of further respiratory compromise.*

Nursing Analysis

Fear related to unfamiliar setting or learned response to difficulty breathing as evidenced by apprehensiveness (clinging, crying, fussing, lack of cooperation) or verbalization.

Goal/Outcome

Fear will be reduced: decreased episodes of crying or fussing, happy and playful at times.

Relieving Fear (interventions with *rationale*)

- Establish trusting relationship with child and family *to decrease anxiety and fear.*
- Utilize play *to gain child's cooperation and trust.*
- Explain procedures to child at developmentally appropriate level *to decrease fear of unknown.*
- Provide favorite blanket or bear as well as comfort measures preferred by child such as rocking or music *for added security.*
- Involve parents in care *to give child reassurance and decrease fear.*

Based on the top three patient problems for Alexander, describe appropriate nursing interventions.

Providing Oxygen Supplementation

Oxygen may be delivered to the child by a variety of methods (Fig. 40.5). Since oxygen administration is considered a drug, it requires a primary provider's or nurse practitioner's order, except when following emergency protocols outlined in a health care facility's policies and procedures. Many health care settings

FIGURE 40.5 **A.** Simple oxygen mask provides about 40% oxygen. **B.** The nasal cannula provides an additional 4% oxygen per 1 L of oxygen flow (i.e., 1 L will deliver 25% oxygen). **C.** The nonrebreather mask provides 80% to 100% oxygen.

develop specific guidelines for oxygen administration that are often coordinated by respiratory therapists, yet the nurse remains responsible for ensuring that oxygen is administered properly.

Oxygen sources include wall-mounted systems as well as cylinders. The supply of oxygen available from a wall-mounted source is limitless, but use of a wall-mounted source restricts the child to the hospital room. Cylinders are portable oxygen tanks; the D-cylinder holds a little less than 400 L of oxygen, and the E-cylinder holds about 650 L of oxygen. Cylinders turn on with a gauge attached to the top of the tank. The cylinder is useful for the child on low-flow oxygen because it allows for mobility.

The tank empties relatively quickly if the child requires a high flow of oxygen, so this is not the best oxygen source in an emergency. Respiratory therapists usually maintain the respiratory equipment that is found in the emergency room or hospital. However, in an outpatient setting, the nurse may be responsible for maintaining respiratory equipment and checking the level of oxygen in the office's oxygen tanks each day.

TAKE NOTE!

Oxygen is highly flammable, so use safety precautions. Post signs ("Oxygen in Use"); inform the family to avoid matches, lighters, and flammable or volatile materials; and use only facility-approved equipment.

The efficiency of oxygen delivery systems is affected by several variables, including the child's respiratory effort, the liter flow of oxygen delivered, and whether the equipment is being used appropriately. In general, oxygen facemasks come in infant, child, and adult sizes. Select the mask that best fits the child. In addition, ensure that the mask is sealed properly to decrease the amount of oxygen that escapes from the mask. Ensure that the liter flow is set according to the manufacturer's recommendations for use with that particular delivery method. The oxygen flow rate or concentration is usually determined by the primary provider's or nurse practitioner's order. Whichever method of delivery is used, provide humidification during oxygen delivery to prevent drying of nasal passages and to assist with liquefying secretions. Table 40.1 provides details on oxygen delivery methods.

CLINICAL REASONING ALERT!

Monitor vital signs, color, respiratory effort, pulse oximetry, and level of consciousness before, during, and after oxygen therapy to evaluate its effectiveness.

ACUTE INFECTIOUS DISORDERS

Acute infectious disorders include the common cold, sinusitis, influenza, pharyngitis, tonsillitis, laryngitis, croup syndromes, respiratory syncytial virus (RSV), pneumonia, and bronchitis.

TABLE **40.1** • Oxygen Delivery Methods

Delivery Method	Description	Nursing Implications
Simple mask	Provides 35%–60% oxygen with a flow rate of 6–10 L/min; oxygen delivery percentage is affected by respiratory rate, inspiratory flow, and adequacy of mask fit.	• Must maintain oxygen flow rate of at least 6 L/min to maintain inspired oxygen concentration and prevent rebreathing of carbon dioxide • Mask must fit snugly to be effective but should not be so tight as to irritate the face.
Venturi mask	Provides 24%–50% oxygen by using a special gauge at the base of the mask that allows mixing of room air with oxygen flow.	• Set oxygen flow rate according to percentage of oxygen desired as indicated on the gauge/dial. • As with simple mask, must fit snugly
Nasal cannula	Provides low oxygen concentration (22%–44%)	• Must be used with humidification to prevent drying and irritation of airways • Can provide very small amounts of oxygen (as low as 25 mL/min) • Maximum recommended liter flow in children is 4 L/min. • Children can eat or talk while on oxygen. • Inspired oxygen concentration affected by mouth breathing • Requires patent nasal passages
Oxygen tent	Provides high-humidity environment with up to 50% oxygen concentration	• Oxygen level drops when tent is opened. • Must change linen frequently as it becomes damp from the humidity. • Secure edges of tent with blankets or by tucking edges under mattress. • Young children may be fearful and resistant. • Mist may interfere with visualization of child inside tent.
Oxygen hood	Provides high concentration (up to 80%–90%) for infants only; allows easy access to chest and lower body	• Liter flow must be set at 10–15 L/min. • Good method for infant but need to remove for feeding • Can and should be humidified

TABLE 40.1 • Oxygen Delivery Methods

Delivery Method	Description	Nursing Implications
Partial rebreathing mask	Simple facemask with an oxygen reservoir bag. Provides 50%–60% oxygen concentration	• Must set liter flow rate at 10–12 L/min to prevent rebreathing of carbon dioxide • The reservoir bag does not completely empty when child inspires if flow rate is set properly.
Nonrebreathing mask	Simple facemask with valves at the exhalation ports and an oxygen reservoir bag with a valve to prevent exhaled air from entering the reservoir; provides 95% oxygen concentration	• Must set liter flow rate at 10–12 L/min to prevent rebreathing of carbon dioxide • The reservoir bag does not completely empty when child inspires if flow rate is set properly.

Data from American Heart Association, & American Academy of Pediatrics. (2020). *Pediatric advanced life support: Provider manual.* American Heart Association; Wolters Kluwer Health. (2023). *Lippincott nursing procedures* (9th ed.). Author.

Common Cold

The common cold is also referred to as a viral upper respiratory infection (URI) or nasopharyngitis. Colds can be caused by rhinoviruses, parainfluenza, RSV, enteroviruses, adenoviruses, and human metapneumovirus. Viral particles spread through the air or from person-to-person contact. Colds occur more frequently in the winter. They affect children of all ages and have a higher incidence among children who attend day care and school-age children (Yoon et al., 2022). It is not unusual for a child to have six to nine colds per year. Spontaneous resolution of the common cold occurs after about 7 to 10 days. Potential complications include secondary bacterial infections of the ears, throat, sinuses, or lungs.

Therapeutic management of the common cold is directed toward symptom relief. Nasal congestion may be relieved via humidity and use of normal saline nasal wash or spray followed by suctioning. Antihistamines are not indicated, as they dry secretions further. Over-the-counter cold preparations are available singly and in combinations. These preparations have not been proven to reduce the length or severity of the cold but may offer symptomatic relief in some children older than 6 years of age (they are not recommended in children younger than the age of 4 due to side effects) (Yoon et al., 2022). See Healthy People 2030 box.

HEALTHY PEOPLE 2030

Objective	Nursing Significance
Reduce inappropriate antibiotic use in outpatient settings.	• Appropriately educate families that the cause of the common cold is several viruses and that antibiotics are inappropriate for the treatment of viral infections. • Encourage families to use measures such as normal saline nasal washes to decrease symptoms associated with the common cold more quickly.

Healthy People Objectives retrieved from http://www.healthypeople.gov

TAKE NOTE!

Over-the-counter cold preparations containing decongestants intended for use in infants and toddlers are no longer on the market. The products are labeled "not for use in children under 4 years of age" (U.S. Food and Drug Administration, 2023).

Nursing Assessment

The child may have either a stuffy or runny nose. Nasal discharge is usually thin and watery at first but may become thicker and discolored. The color of nasal discharge is not an accurate indicator of viral versus bacterial infection. The child may be hoarse and complain of a sore throat. Cough usually produces very little sputum. Fever, fatigue, watery eyes, and appetite loss may also occur. Symptoms are generally at their worst over the first few days and then decrease over the course of the illness.

Assess for risk factors such as day care or school attendance. Inspect for edema and vasodilation of the mucosa. Diagnosis is based on clinical presentation rather than laboratory or x-ray studies. Comparison Chart 40.1 differentiates causes of nasal congestion.

Nursing Management

Nursing management of the child with a common cold consists of promoting comfort, providing family education, and preventing spread of the cold.

Promoting Comfort

Provide supportive measures such as normal saline nose drops and bulb syringe suctioning for the relief of nasal congestion in infants and toddlers. Teach older children to use a normal saline nose spray to mobilize secretions. A cool mist humidifier also helps with nasal congestion. If over-the-counter nose sprays are used in children,

COMPARISON CHART 40.1 Causes of Nasal Congestion

Sign or Symptom	Allergic Rhinitis	Common Cold	Sinusitis
Length of illness	Varies; may have year-round symptoms	10 days or less	Longer than 10–14 days
Nasal discharge	Thin, watery, clear	Thick, white, yellow, or green; can be thin	Thick, yellow or green
Nasal congestion	Varies	Present	Present
Sneezing	Varies	Present	Absent
Cough	Varies	Present	Varies
Headache	Varies	Varies	Varies
Fever	Absent	Varies	Varies
Bad breath	Absent	Absent	Varies

remind parents they are only for very short-term use. Promote adequate oral fluid intake to liquefy secretions.

Educate parents about the use of cold and cough medications. Although they may offer some symptomatic relief, they have not been proven to shorten the length of cold symptoms. Counsel parents to use the appropriate product depending on the symptom relief desired, rather than a combination product. Products containing acetaminophen combined with other "cold symptom" medications may mask a fever in the child who is developing a secondary bacterial infection. As with all viral infections in children, teach parents that aspirin use should be avoided because of its association with Reye syndrome (Stanford Children's Health, 2024).

Providing Family Education

Currently, there are no medications available to treat the viruses that cause the common cold, so symptomatic treatment is all that is necessary. Antibiotics are not indicated unless the child also has a bacterial infection. Explain to parents the importance of reserving antibiotic use for appropriate illnesses. Provide education about the use of normal saline nose drops and bulb suctioning to clear the infant's nose of secretions. Normal saline nasal wash using a bulb syringe to instill the solution is also helpful for children of all ages with nasal congestion. Although normal saline for nasal administration is available commercially, parents can also make it at home (Box 40.2). Teaching Guidelines 40.1 gives instructions on use of the bulb syringe.

BOX 40.2 Homemade Saltwater Nose Drops

Mix 8 oz distilled water, a half teaspoon of sea salt, and a quarter teaspoon of baking soda. Keep for 24 hours in the refrigerator but allow to come to room temperature prior to use.

Counsel parents about how to recognize complications of the common cold, which include:

- Prolonged fever
- Increased throat pain or enlarged, painful lymph nodes
- Increased or worsening cough, cough lasting longer than 10 days, chest pain, difficulty breathing
- Earache, headache, toothache, or sinus pain
- Unusual irritability or lethargy
- Skin rash

If complications do occur, tell parents to notify the primary provider or nurse practitioner for further instructions or reassessment.

Preventing the Common Cold

Teaching about ways to prevent the common cold is a vital nursing intervention. Explain that frequent handwashing helps to decrease the spread of viruses that cause the common cold. Teach parents and family to avoid secondhand smoke as well as crowded places, especially during the winter. Avoid close contact with individuals known to have a cold. Encourage parents and families to consume a healthy diet and get enough rest.

CONSIDER THIS!

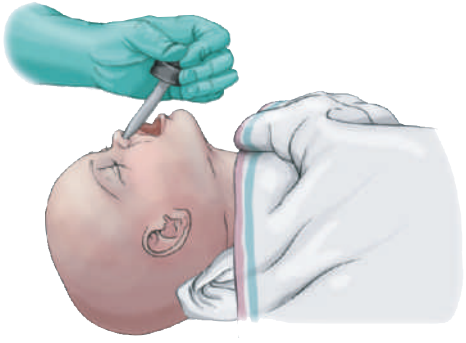
Corey Davis, a 3-year-old, is brought to the clinic by their parent. They present with a runny nose, congestion, and a nonproductive cough. The parent says, "My child's miserable." "I just don't know what to do." "Ever since I put them in day care, they get sick every few weeks." "This is all my fault."

How should the nurse respond? How would you feel if your child was healthy until entering day care? What type of support can the nurse provide to Corey's parent?

TEACHING GUIDELINES 40.1 Using the Bulb Syringe to Suction Nasal Secretions

1. Hold the infant on your lap or on the bed with the head tilted slightly back.

2. If using saline, instill several drops of saline solution in one of the infant's nostrils.



3. Compress the sides of the bulb syringe completely. Use only a rubber-tipped bulb syringe. Place the rubber tip in the infant's nose.

4. Release pressure on the bulb.

5. Remove the syringe, and squeeze bulb over tissue or the sink to empty it of secretions.

6. Repeat on other nostril if necessary. Using a bulb syringe prior to bottle-feeding or breastfeeding may relieve congestion enough to allow the infant to suck more efficiently.
7. Clean the bulb syringe thoroughly with warm water after each use and allow to air dry.

Sinusitis

Sinusitis (also called rhinosinusitis) generally refers to a bacterial infection of the paranasal sinuses. The disease may be either acute or chronic in nature. In young children, the maxillary and ethmoid sinuses are the main sites of infection. After age 10 years, the frontal sinuses may be more commonly involved (Yoon et al., 2022). Mucosal swelling, decreased ciliary movement, and thickened nasal discharge all contribute to bacterial invasion of the nose. Nasal polyps also place the child at risk for bacterial sinusitis. Complications include orbital cellulitis and intracranial infections, such as subdural empyemas.

Symptoms lasting less than 30 days generally indicate acute sinusitis, whereas symptoms persisting longer than 4 to 6 weeks usually indicate chronic sinusitis.

Sinusitis is managed with antibiotic treatment. The therapeutic management approach varies with chronicity. The course of treatment is usually 14 days. Naturally, chronic sinusitis requires a longer course of treatment than acute sinusitis. Surgical therapy may be indicated for children with chronic sinusitis, particularly if it is recurrent or if nasal polyps are present.

Nursing Assessment

The most common presentation of sinusitis is persistent signs and symptoms of a cold. Rather than improving after 7 to 10 days, nasal discharge persists. Explore the history for:

- Cough
- Fever
- In preschoolers or older children, halitosis (bad breath)
- Facial pain may or may not be present so is not a reliable indicator of disease
- Eyelid edema (in the case of ethmoid sinus involvement)
- Irritability
- Poor appetite

Assess for risk factors such as a history of recurrent cold symptoms or a history of nasal polyps.

On physical examination, note eyelid swelling, extent of nasal drainage, and halitosis. Inspect the throat for postnasal drainage. Inspect the nasal mucosa for erythema. Palpate the sinuses, noting pain with mild pressure. The diagnosis may be made based on the history and clinical presentation. The use of x-ray, CT scan, or MRI is not necessary as they are not specific and do not distinguish viral from bacterial infection (Yoon et al., 2022). (Refer to Comparison Chart 40.1, which differentiates the causes of nasal congestion.)

Nursing Management

Normal saline nose drops or spray, cool mist humidifiers, and adequate oral fluid intake are recommended for children with sinusitis. Teach families the importance of continuing the full course of antibiotics to eradicate the cause of infection. Also educate the family that the use of decongestants and antihistamines as adjuncts in the treatment of sinusitis has not been shown to be beneficial, although intranasal steroids may benefit those with allergic rhinitis (Yoon et al., 2022). Advise parents that normal saline nose spray or nasal washes may promote drainage.

Influenza

Influenza viral infection (known commonly as the "flu") occurs primarily during the winter. It is spread through inhalation of droplets or contact with fine-particle aerosols. Infected children shed the virus for 1 to 2 days before symptoms begin and may continue shedding the virus in increased amounts (as compared to adults) for as long as 2 weeks. Average annual infection rates in children range from 10% to 40% (Munoz & Edwards, 2023). Influenza viruses primarily affect the upper respiratory epithelium but can cause systemic effects as well. Children with chronic heart or lung conditions, diabetes, chronic renal disease, or immune deficiency are at higher risk for more severe influenza infection compared to other children.

Bacterial infections of the respiratory system commonly occur as complications of influenza infection, severe pneumococcal pneumonia in particular. Otitis media occurs in 10% to 50% of children with influenza (Munoz & Edwards, 2023). Rarely, Reye syndrome occurs in children with influenza who have taken aspirin. Acute myositis is a rare and severe complication, which is particular to children. A sudden onset of severe pain and tenderness in both calves causes the child to refuse to walk. Due to the potential for complications, a prolonged fever or a fever that returns during convalescence should be investigated.

> **TAKE NOTE!**
>
> Current recommendations are for all children older than 6 months of age to be immunized yearly against influenza (CDC, 2023c).

Nursing Assessment

Children who attend day care or school are at higher risk for influenza infection than those who are routinely at home. Note the presence of risk factors for severe disease, such as chronic heart or lung disease (such as asthma), diabetes, chronic renal disease, or immune deficiency or children with cancer receiving chemotherapy. School-age children and adolescents experience the illness similarly to adults. Abrupt onset of fever, facial flushing, chills, headache, myalgia, and malaise are accompanied by cough and **coryza** (nasal discharge). About half of infected individuals have a dry or sore throat. Ocular symptoms such as photophobia, tearing, burning, and eye pain are common.

Infants and young children exhibit symptoms similar to other respiratory illnesses. Fever greater than 39.5°C is common. Infants may be mildly toxic in appearance and irritable and have a cough, coryza, and pharyngitis. Wheezing may occur, as influenza can also cause bronchiolitis. An erythematous rash may be present, and diarrhea may also occur. The diagnosis may be confirmed by a rapid assay test.

Nursing Management

Nursing management of influenza is mainly supportive. Provide symptomatic treatment of cough and

fever. Instruct parents on the maintenance of hydration. Administer antiviral drugs as prescribed as they can reduce the symptoms associated with influenza if they are started within the first 48 hours of the illness (UpToDate, Inc., 2024).

Pharyngitis

Inflammation of the throat mucosa (pharynx) is referred to as pharyngitis. A sore throat may accompany nasal congestion and is often viral in nature. A bacterial sore throat most often occurs without nasal symptoms. Group A streptococci account for 20% to 30% of cases, with the remainder being caused by other viruses or bacteria (Yoon et al., 2022).

Suppurative complications of group A streptococcal infection include peritonsillar or retropharyngeal abscess. Peritonsillar abscess may be noted by asymmetric swelling of the tonsils, shifting of the uvula to one side, and palatal edema. Retropharyngeal abscess may progress to the point of airway obstruction, hence requiring careful evaluation and appropriate treatment. Additional complications include acute rheumatic fever (see Chapter 41) and acute glomerulonephritis (see Chapter 43).

Viral pharyngitis is usually self-limited and does not require therapy beyond symptomatic relief. Group A streptococcal pharyngitis requires antibiotic therapy. If either the rapid diagnostic test or throat culture (described below) is positive for group A streptococci, penicillin is generally prescribed. Appropriate alternative antibiotics include amoxicillin and, for those allergic to penicillin, macrolides and cephalosporins.

TAKE NOTE!

A "strep carrier" is a child who has a positive throat culture for streptococci when asymptomatic. Strep carriers are not at risk for complications from streptococci, as are those who are acutely infected with streptococci and are symptomatic (Yoon et al., 2022).

Nursing Assessment

Inquire about sudden onset of pharyngitis. The history may include a fever, sore throat and difficulty swallowing, headache, and abdominal pain. Ask about recent incidence of viral or strep throat in the family, day care center, or school.

Inspect the pharynx and tonsils, which may demonstrate varying degrees of inflammation (Fig. 40.6). Exudate may be present but is not diagnostic of bacterial infection. Note the presence of petechiae on the palate. Inspect the tongue for a strawberry appearance. Palpate for enlargement and tenderness of the anterior cervical nodes. Inspect the skin for a fine, red, sandpaper-like rash (called scarlatiniform), particularly on the trunk or abdomen, a common finding with streptococcus A infection.

FIGURE 40.6 Note the redness of the pharynx, tonsillar exudate, and white strawberry tongue coating.

The nurse may obtain a throat swab for rapid diagnostic testing and throat culture. The rapid strep test is a sensitive and reliable measure, rarely resulting in false-positive readings (Yoon et al., 2022). If the rapid strep test is negative, the second swab may be sent for a throat culture.

• • • ATRAUMATIC CARE • • •

When obtaining two swabs for rapid strep testing and throat culture, swab the applicators simultaneously to decrease perceived trauma to the child.

Nursing Management

Nursing management of the child with pharyngitis focuses on promoting comfort and providing family education.

Promoting Comfort

Teach families that saline gargles (made with 8 oz of warm water and a half teaspoon of table salt) are soothing for children old enough to cooperate. Administering analgesics such as acetaminophen and ibuprofen may ease fever and pain. Educate families that sucking on throat lozenges or hard candy may also ease pain. Providing cool mist humidity helps to keep the mucosa moist in the event of mouth breathing. Encourage the child to ingest popsicles, cool liquids, and ice chips to maintain hydration.

Providing Family Education

Parents may often need additional education about treatments as they may be accustomed to "sore throats" being treated with antibiotics. However, teach parents that in the case of a viral cause, antibiotics will not be necessary and the pharyngitis will resolve in a few days. For the child with streptococcal pharyngitis, urge parents to have the child complete the entire prescribed course of antibiotics. After 24 hours of antibiotic therapy, instruct the parents to discard the child's toothbrush to avoid reinfection. Educate parents that children may return to day care or school after they have been receiving antibiotics for 24 hours; they are considered noncontagious at that point.

Tonsillitis

Inflammation of the tonsils often occurs with pharyngitis and, thus, may also be viral or bacterial in nature. Viral infections require only symptomatic treatment. Treatment for bacterial tonsillitis is the same as for bacterial pharyngitis. Occasionally, surgical intervention is warranted. Tonsillectomy (surgical removal of the palatine tonsils) may be indicated for the child with recurrent streptococcal tonsillitis or massive tonsillar hypertrophy or for other reasons. When hypertrophied adenoids obstruct breathing, then adenoidectomy (surgical removal of the adenoids) may be indicated.

Nursing Assessment

Note whether fever is present currently or by history. Inquire about the history of recurrent pharyngitis or tonsillitis. Note if the child's voice sounds muffled or hoarse. Inspect the pharynx for redness and enlargement of the tonsils. As the tonsils enlarge, the child may experience difficulty breathing and swallowing. When tonsils touch at the midline ("kissing tonsils" or 4+ in size), the airway may become obstructed. Also, if the adenoids are enlarged, the posterior nares become obstructed. The child may breathe through the mouth and may snore. Palpate the anterior cervical nodes for enlargement and tenderness. Rapid test or culture may be positive for streptococcus A.

Nursing Management

Tonsillitis that is medically treated requires the same nursing management as pharyngitis. Nursing care for the child after tonsillectomy is described further on.

Promoting Airway Clearance

Until fully awake, place the child in a side-lying or prone position to facilitate safe drainage of secretions. Once alert, the child may prefer to sit up or have the head of the bed elevated. Suctioning, if necessary, should be done carefully to avoid trauma to the surgical site. Note that dried blood may be present on the teeth and the nares, with old blood present in emesis. Since the presence of blood can be very frightening to parents, alert them to this possibility.

Maintaining Fluid Volume

Although unusual postoperatively, monitor for hemorrhage as it may occur any time from the immediate postoperative period to as late as 10 days after surgery. Inspect the throat for bleeding. Mucus tinged with blood may be expected, but fresh blood in the secretions indicates bleeding. Watch for continuous swallowing of small amounts of blood while awake or sleeping as this may indicate early bleeding. Monitor for other signs of hemorrhage, including tachycardia, pallor, restlessness, frequent throat clearing, and emesis of bright red blood.

To avoid trauma to the surgical site, discourage the child from coughing, clearing the throat, blowing the nose, and using straws. Upon discharge, instruct the parents to immediately report any sign of bleeding to the primary provider or nurse practitioner. To maintain fluid volume postoperatively, encourage children to take any fluids they desire; popsicles and ice chips are particularly soothing. Citrus juice and brown or red fluids should be avoided: the acid in citrus juice may irritate the throat, and red or brown fluids may be confused with blood if vomiting occurs.

Relieving Pain

Educate families that for the first 24 hours after surgery, the throat is very sore. Provide adequate pain relief (may be with or without narcotics) to establish adequate oral fluid intake. Apply an ice collar if prescribed. Counsel parents to maintain pain control upon discharge from the facility, not only for the child's sake but also to enable the child to continue to drink fluids.

Infectious Mononucleosis

Infectious mononucleosis is a self-limited illness caused by the Epstein–Barr virus. It is characterized by fever, malaise, sore throat, and lymphadenopathy. Mononucleosis is commonly called the "kissing disease" since it is transmitted by oropharyngeal secretions. It can occur at any age but is most often diagnosed in adolescents and young adults (Aronson & Auwaerter, 2023). Some infected individuals may have concomitant streptococcal pharyngitis. Complications include splenic rupture, Guillain–Barré syndrome, and aseptic meningitis.

Nursing Assessment

Note any history of exposure to infected individuals. Determine history of fever and onset and progression of sore throat, malaise, and other complaints. Observe for periorbital edema. Inspect the pharynx and tonsils for inflammation and patches of gray exudate. Petechiae may be present on the palate. Palpate for bilateral nontender enlargement

of the posterior cervical lymph nodes. After 3 to 5 days of illness, the pharynx may become edematous and the tonsillar exudate more extensive. Lymphadenopathy may progress to include the anterior cervical nodes, which may become tender. Palpate the abdomen for splenomegaly or hepatomegaly. An erythematous maculopapular rash may appear as the illness progresses. Definitive diagnosis may be made by Monospot or Epstein–Barr virus titers.

TAKE NOTE!

The Monospot may be negative if obtained within the first 7 days of illness with infectious mononucleosis. Epstein–Barr virus titer is reliable at any point in the illness (Aronson & Auwaerter, 2023).

Nursing Management

Nursing management of mononucleosis is primarily symptomatic. The throat may be very sore, so encourage families to administer analgesics and provide the child with saltwater gargles. Encourage bed rest while the child is febrile. Instruct the child and family that frequent rest periods may be necessary for several weeks after the onset of illness, as fatigue may persist as long as 6 weeks. During the acute phase, if tonsillar or pharyngeal edema threatens to obstruct the airway, administer corticosteroids as prescribed to decrease the inflammation. When children or teens have splenomegaly or hepatomegaly, educate the child and family that strenuous activity and contact sports should be avoided. Ensure parents understand that the appearance of a rash or jaundice should be reported to the primary provider or nurse practitioner.

Laryngitis

Inflammation of the larynx is termed laryngitis. It may occur alone or in conjunction with other respiratory symptoms. It is characterized by a hoarse voice or loss of the voice (so soft as to make it difficult to hear). Oral fluids might offer relief, but resting the voice for 24 hours will allow the inflammation to subside. Laryngitis alone requires no further intervention.

Croup

Children between 3 months and 3 years of age are the most frequently affected with croup, rarely affecting children over age 6 (Woods, 2023). Croup is also referred to as laryngotracheobronchitis because inflammation and edema of the larynx, trachea, and bronchi occur as a result of viral infection. Parainfluenza is responsible for most cases of croup, although other viruses may also be implicated (Woods, 2023). The inflammation and edema obstruct the airway, resulting in symptoms. Mucus production also occurs, further contributing to obstruction of the airway. Narrowing of the subglottic area of the trachea results in audible inspiratory stridor. Edema of the larynx causes hoarseness. Inflammation in the larynx and trachea causes the characteristic barking cough of croup.

Symptoms occur most often at night, presenting suddenly, with resolution of symptoms in the morning. Croup is usually self-limited, lasting only about 3 to 5 days. Complications of croup are rare but may include worsening respiratory distress, hypoxia, or bacterial superinfection (as in the case of bacterial tracheitis).

Croup is usually managed on an outpatient basis, with affected children rarely requiring hospitalization. Corticosteroids (usually a single dose) are used to decrease inflammation, and racemic epinephrine aerosols demonstrate the alpha-adrenergic effect of mucosal vasoconstriction, helping to decrease edema. Children with croup may be hospitalized if they have significant stridor at rest or severe retractions after a several-hour period of observation. Comparison Chart 40.2 compares croup to epiglottitis.

COMPARISON CHART 40.2 Croup Versus Epiglottitis

	Spasmodic Croup	Epiglottitis
Preceding illness	None or minimal coryza	None or mild upper respiratory infection
Age group usually affected	3 months to 3 years	1–8 years
Onset	Usually sudden, often at night	Rapid (within hours)
Fever	Variable	High
Barking cough, hoarseness	Yes	No
Dysphagia	No	Yes
Toxic appearance	No	Yes
Cause	Viral	*Haemophilus influenzae type B*

Nursing Assessment

Note the age of the child; children between 3 months and 3 years of age are most likely to present with viral croup (laryngotracheobronchitis). History may reveal a cough that developed during the night (most common presentation) and that sounds like barking (or a seal). Inspect for the presence of mild URI symptoms. Temperature may be normal or elevated mildly. Listen for inspiratory stridor, and observe for suprasternal retractions. Auscultate the lungs for adequacy of breath sounds. Croup is usually diagnosed based on history and clinical presentation, but a lateral neck radiograph may be obtained to rule out epiglottitis.

CLINICAL REASONING ALERT!

The child with fever, a toxic appearance, and increasing respiratory distress despite appropriate croup treatment may have bacterial tracheitis (Woods, 2023). Notify the primary provider or nurse practitioner of these findings in a child with croup.

Nursing Management

If the child's care is being managed at home, advise parents about the symptoms of respiratory distress, and instruct them to seek treatment if the child's respiratory condition worsens. Teach parents to expose their child to humidified air (via a cool mist humidifier or steamy bathroom). Although never clinically proven, use of humidified air has long been recommended for alleviating coughing jags and has anecdotally been reported as helpful (particularly exposure to cooler air). Administer dexamethasone if ordered or teach parents about home administration. Explain to parents that the effects of racemic epinephrine last about 2 hours and that the child must be observed closely as occasionally a child will worsen again, requiring another aerosol. Teaching Guidelines 40.2 provides information about home care of croup.

TEACHING GUIDELINES 40.2 Home Care of Croup

- Keep the child quiet and discourage crying.
- Allow the child to sit up (in your arms).
- Encourage rest and fluid intake.
- If stridor occurs, take the child into a steamy bathroom for 10 minutes.
- Administer medication (corticosteroid) as directed.
- Watch the child closely. Call the primary provider or nurse practitioner if:
  - the child breathes faster, has retractions, or has any other difficulty breathing.
  - the nostrils flare or the lips or nails have a bluish tint.
  - the cough or stridor does not improve with exposure to moist air.
  - restlessness increases or the child is confused.
  - the child begins to drool or cannot swallow.

Adapted from Schare, R. S. (2021). *Croup.* https://kidshealth.org/en/parents/croup.html

Epiglottitis

Epiglottitis (inflammation and swelling of the epiglottis) is most often caused by *Haemophilus influenzae* type b and has become a rare occurrence with the extensive use of the Hib vaccine since the 1980s (Houin et al., 2022). Respiratory arrest and death may occur if the airway becomes completely occluded. Additional complications include pneumothorax and pulmonary edema. Therapeutic management focuses on airway maintenance and support. Intravenous antibiotic therapy is necessary. The child will be managed in the intensive care unit. See Comparison Chart 40.2 for information comparing croup to epiglottitis.

Nursing Assessment

Carefully assess the child with suspected epiglottitis. Note sudden onset of symptoms and high fever. The child has an overall toxic appearance. They may refuse to speak or may speak only with a very soft voice. The child may refuse to lie down and may assume the characteristic position: sitting forward with the neck extended. Drooling may be present. Note anxiety or a frightened appearance. Note the child's color. Cough is usually absent. A lateral neck radiograph may be performed to determine whether epiglottitis is present. This is done cautiously, so as not to induce airway obstruction with changes in position of the child's neck.

CLINICAL REASONING ALERT!

Do not under any circumstance attempt to visualize the throat: reflex laryngospasm may occur, precipitating immediate airway occlusion.

Nursing Management

Do not leave the child unattended. Keep the child and parents as calm as possible. Allow the child to assume a position of comfort. Do not place the child in a supine position, as airway occlusion may occur. Provide 100% oxygen in the least invasive manner that is acceptable to the child. If the child with epiglottitis experiences complete airway occlusion, an emergency **tracheostomy** (incision in trachea to permit breathing) may be necessary. Ensure that emergency equipment is available and that personnel trained in intubation of the pediatric occluded airway and percutaneous tracheostomy are notified of the child's presence in the facility.

CLINICAL REASONING ALERT!

Epiglottitis is characterized by dysphagia, drooling, anxiety, irritability, and significant respiratory distress. Prepare for the event of sudden airway occlusion.

Bronchiolitis

Bronchiolitis is an acute inflammatory process of the bronchioles and small bronchi. Nearly always caused by a viral pathogen, RSV accounts for the majority of cases of bronchiolitis, with adenovirus, parainfluenza, and human meta-pneumovirus also being important causative agents. This discussion will focus on RSV bronchiolitis.

The peak incidence of bronchiolitis is in the fall and winter, coinciding with RSV season, which in the United States and Canada generally begins in September or October and continues through early spring. Virtually all children will contract RSV infection within the first few years of life. RSV bronchiolitis occurs most often in infants and toddlers (Piedra, 2023). The severity of disease is related inversely to the age of the child. The frequency and severity of RSV infection decrease with age. Repeated RSV infections occur throughout life but are usually localized to the upper respiratory tract after toddlerhood.

Pathophysiology

RSV is a highly contagious virus and may be contracted through direct contact with respiratory secretions or from particles on objects contaminated with the virus. RSV invades the nasopharynx, where it replicates and then spreads down to the lower airway via aspiration of upper airway secretions. RSV infection causes necrosis of the respiratory epithelium of the small airways, peribronchiolar mononuclear infiltration, and plugging of the lumens with mucus and exudate. The small airways become variably obstructed; this allows adequate inspiratory volume but prevents full expiration. This leads to hyperinflation and atelectasis. Serious alterations in gas exchange occur, with arterial hypoxemia and carbon dioxide retention resulting from mismatching of pulmonary ventilation and perfusion. Hypoventilation occurs secondary to markedly increased work of breathing.

Therapeutic Management

Management of RSV focuses on supportive treatment. Supplemental oxygen, nasal and/or nasopharyngeal suctioning, and oral or intravenous hydration are used. Many infants are managed at home with close observation and adequate hydration. Hospitalization is required for children with more severe disease. The infant with tachypnea, significant retractions, poor oral intake, or lethargy can deteriorate quickly, to the point of requiring ventilatory support, and thus warrants hospital admission.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter. Assessment findings pertinent to RSV bronchiolitis are discussed further on.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Onset of illness with a clear runny nose (sometimes profuse)
- Pharyngitis
- Low-grade fever
- Development of cough 1 to 3 days into the illness, followed by a wheeze shortly thereafter
- Poor feeding

Explore the child's current and past medical history for risk factors such as:

- Young age (younger than 2 years old), more severe disease in a child younger than 6 months old
- Prematurity
- Multiple birth
- Birth during April to September
- History of chronic lung disease (bronchopulmonary disease)
- Cyanotic or complicated congenital heart disease
- Immunocompromise
- Male sex
- Exposure to passive tobacco smoke
- Crowded living conditions
- Day care attendance
- School-age siblings
- Low socioeconomic status
- Lack of breastfeeding

Physical Examination

Examination of the child with RSV involves inspection, observation, and auscultation.

INSPECTION AND OBSERVATION

Observe the child's general appearance and color (centrally and peripherally). The infant with RSV bronchiolitis might appear air-hungry, exhibiting various degrees of cyanosis and respiratory distress, including tachypnea, retractions, accessory muscle use, grunting, and periods of apnea. Cough and audible wheeze might be heard. The infant might appear listless and uninterested in feeding, surroundings, or parents.

AUSCULTATION

Auscultate the lungs, noting adventitious sounds and determining the quality of aeration of the lung fields.

Earlier in the illness, wheezes might be heard scattered throughout the lung fields. In more serious cases, the chest might sound quiet and without wheeze. This is due to significant hyperexpansion with very poor air exchange.

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the assessment of RSV bronchiolitis include:

- Pulse oximetry: oxygen saturation might be decreased significantly.
- Chest radiograph: might reveal hyperinflation and patchy areas of atelectasis or infiltration.
- Blood gases: might show carbon dioxide retention and **hypoxemia** (low oxygen concentration in blood).
- Nasal-pharyngeal washings: positive identification of RSV can be made via enzyme-linked immunosorbent assay (ELISA) or immunofluorescent antibody (IFA) testing.

Nursing Management

RSV infection is usually self-limited, and patient problems, goals, and interventions for the child with bronchiolitis are aimed at supportive care. Children with less severe disease might require only antipyretics, adequate hydration, and close observation. They can often be successfully managed at home, provided the primary caregiver is reliable and comfortable with close observation. Teach parents or caregivers to watch for signs of worsening and to seek care quickly should the child's condition deteriorate.

Hospitalization is required for children with more severe disease, and children admitted with RSV bronchiolitis warrant close observation. In addition to the patient problems and related interventions discussed in the "Clinical Judgment and the Nursing Process" section earlier in this chapter, interventions common to bronchiolitis follow.

Maintaining Patent Airway

Position the child with the head of the bed elevated to facilitate an open airway. Frequently assess airway patency and suction as needed. Use a Yankauer or tonsil-tip suction catheter to suction the mouth or pharynx of older infants or children, rinsing the catheter after each suctioning. Nasal bulb suctioning may be sufficient to clear the airway in some infants, while others will require nasopharyngeal suctioning with a suction catheter. Nursing Procedure 40.1 gives further information. Adjust the pressure ranges for suctioning infants and children between 60 and 100 mm Hg (40 to 60 mm Hg for premature infants).

NURSING PROCEDURE 40.1 Nasopharyngeal or Artificial Airway Suction Technique

1. Make sure the suction equipment works properly before starting.
2. After washing your hands, assemble the equipment needed:
   - Appropriate-size sterile suction catheter
   - Sterile gloves
   - Supplemental oxygen
   - Sterile water–based lubricant
   - Sterile normal saline if indicated
3. Don sterile gloves, keeping dominant hand sterile and nondominant hand clean.
4. Preoxygenate the infant or child if indicated.
5. Apply lubricant to the end of the suction catheter.
6. If indicated for loosening of secretions, instill sterile saline.
7. Maintaining sterile technique, insert the suction catheter into the child's nostril or airway.
   - Insert only to the point of gagging if inserting via the nostril.
   - Insert only 0.5 cm farther than the length of the artificial airway.
8. Intermittently apply suction for no longer than 10 seconds while twisting and removing the catheter.
9. Supplement with oxygen after suctioning.

Promoting Adequate Gas Exchange

Assess work of breathing, respiratory rate, and oxygen saturation as infants and children with RSV bronchiolitis might deteriorate quickly as the disease progresses. Adjust the percentage of inspired oxygen (FiO_2) as needed to maintain oxygen saturation within the prescribed range. Position the infant with the head of the bed elevated to improve gas exchange. Frequent assessment is necessary for the hospitalized child with bronchiolitis.

CLINICAL REASONING ALERT!

In the tachypneic infant, slowing of the respiratory rate does not necessarily indicate improvement: often, a slower respiratory rate is an indication of tiring, and carbon dioxide retention may soon be followed by apnea (Weiner, 2022).

Reducing Infection Risk

Since RSV is easily spread through contact with droplets, isolate inpatients according to hospital policy to decrease the risk of nosocomial spread to other children. Safely cohort children with RSV. Maintain attention to handwashing, as droplets might enter the eyes, nose, or mouth via the hands.

Providing Family Education

Educate parents so they can recognize signs of worsening distress. Tell parents to call the primary provider or nurse practitioner if the child's breathing becomes rapid or more difficult or if the child cannot eat secondary to tachypnea. Inform families that children who are younger than 1 year of age or who are at higher risk (those who were born prematurely or who have chronic heart or lung conditions) might have a longer course of illness. Instruct parents that cough can persist for several days to weeks after resolution of the disease but that infants usually act well otherwise.

Preventing RSV Disease

Teach strict adherence to handwashing policies in day care centers and when exposed to individuals with cold symptoms for all age groups. It is recommended that all pregnant people receive the RSV vaccine between 32 and 36 weeks' gestation for protection of newborns and infants through 6 months of age (CDC, 2023b). The vaccine provides 5 months of protection against serious RSV disease. If the birth parent did not receive the RSV vaccine during pregnancy, the infant should receive one dose of nirsevimab (Barr & Graham, 2024). During their second RSV season, infants at increased risk for severe RSV infection who are 8 to 19 months of age should receive a second dose of nirsevimab. Those at high risk include infants and toddlers who have chronic lung disease of prematurity, are immunocompromised, have cystic fibrosis, or are of Native Alaskan or Native American descent (Barr & Graham, 2024). Healthy children over 8 months of age do not require a second dose.

Pneumonia

Pneumonia is an inflammation of the lung parenchyma. It can be caused by a virus, bacteria, *Mycoplasma,* or a fungus. Respiratory viruses are the most common cause of pneumonia in younger children and the least common cause in older children. Viral pneumonia is usually better tolerated in children of all ages. Children with bacterial pneumonia are more apt to present with a toxic appearance, but they generally recover rapidly if appropriate antibiotic treatment is instituted early. *Streptococcus pneumoniae* is a common cause of bacterial pneumonia in all ages of children, and *M. pneumoniae* is a common causative agent in the school-age child and adolescent. Fungal infection may also result in pneumonia. Aspiration pneumonia may result from aspiration of foreign material into the lower respiratory tract. Pneumonia occurs more often in winter and early spring. It is common in children but is seen most frequently in infants and young toddlers.

> **TAKE NOTE!**
>
> Community-acquired pneumonia (CAP) refers to pneumonia in a previously healthy person that is contracted outside of the hospital setting (Barson, 2022).

Pneumonia is usually a self-limited disease. A child who presents with recurrent pneumonia should be evaluated for chronic lung disease such as asthma or cystic fibrosis. Potential complications of pneumonia include bacteremia, pleural effusion, empyema, lung abscess, and pneumothorax. Excluding bacteremia, these complications are often treated with thoracentesis and/or chest tubes as well as antibiotics if appropriate. Pneumatoceles (thin-walled cavities developing in the lung) might occur with certain bacterial pneumonias and usually resolve spontaneously over time.

Therapeutic management of children with less severe disease includes antipyretics, adequate hydration, and close observation. Even bacterial pneumonia can be successfully managed at home if the work of breathing is not severe and oxygen saturation is within normal limits. However, hospitalization is required for children with more severe disease. The child with tachypnea, significant retractions, poor oral intake, or lethargy might require hospital admission for the administration of supplemental oxygen, intravenous hydration, and antibiotics.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter. Assessment findings pertinent to pneumonia are discussed further on.

Health History

Elicit a description of the present illness and chief complaint. Note onset and progression of symptoms. Common signs and symptoms reported during the health history include:

- Antecedent viral URI
- Fever
- Cough (note type and whether productive or not)
- Increased respiratory rate

- History of lethargy, poor feeding, vomiting, or diarrhea in infants
- Chills, headache, dyspnea, chest pain, abdominal pain, and nausea or vomiting in older children

Explore the child's past and current medical history for risk factors known to be associated with an increase in the severity of pneumonia, such as:

- Prematurity
- Malnutrition
- Passive smoke exposure
- Low socioeconomic status
- Day care attendance
- Underlying cardiopulmonary, immune, or nervous system disease (Houin et al., 2022)

Physical Examination

Observe the child's general appearance and color (centrally and peripherally), as the child with bacterial pneumonia may appear ill, and cyanosis might accompany coughing spells. Assess work of breathing, noting substernal, subcostal, or intercostal retractions. Tachypnea and nasal flaring may be present. Describe cough and quality of sputum if produced.

Auscultate the lungs for wheezes or rales in the younger child or local or diffuse rales in the older child. Document diminished breath sounds. Percuss for local dullness over a consolidated area in the older child (percussion is much less valuable in the infant or younger child). Palpate for tactile fremitus, which may be increased with pneumonia.

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the assessment of pneumonia include:

- Pulse oximetry: oxygen saturation might be decreased significantly or within normal range.
- Chest radiograph: varies according to child age and causative agent. In infants and young children, bilateral air trapping and perihilar **infiltrates** (collection of inflammatory cells, cellular debris, and foreign organisms) are the most common findings. Patchy areas of consolidation might also be present. In older children, lobar consolidation is seen more frequently.
- Sputum culture: may be useful in determining causative bacteria in older children and adolescents.
- White blood cell count: might be elevated in the case of bacterial pneumonia.

Nursing Management

Patient problems, goals, and interventions for the child with pneumonia are aimed primarily at providing supportive care and education about the illness and its treatment. Prevention of pneumococcal infection is also important. Children with more severe disease will require hospitalization. Refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter for patient problems and related interventions. In addition to the interventions listed there, the following should be noted.

Providing Supportive Care

Ensure adequate hydration, and assist in thinning of secretions by encouraging oral fluid intake in the child whose respiratory status is stable. Provide intravenous fluids as ordered to children with increased work of breathing to maintain hydration. Allow and encourage the child to assume a position of comfort, usually with the head of the bed elevated to promote aeration of the lungs. If pain due to coughing or pneumonia itself is severe, administer analgesics as prescribed. Provide supplemental oxygen to the child with respiratory distress or **hypoxia** (low oxygen concentration in the tissues) as needed.

Providing Family Education

Educate the family about the importance of adhering to the prescribed antibiotic regimen. Antibiotics may be given intravenously if the child is hospitalized. Oral antibiotics are used on discharge or if the child is managed on an outpatient basis.

Teach the parents of a child with bacterial pneumonia to expect that for 1 to 2 weeks following resolution of the acute illness, the child might continue to tire easily and that the infant might continue to need small, frequent feedings. Cough may also persist after the acute recovery period but should lessen over time.

If the child is diagnosed with viral pneumonia, provide parents with an explanation that antibiotics are not utilized in viral infections (pneumonia is often perceived by the public as a bacterial infection). As with bacterial pneumonia, the child may experience a week or two of weakness or fatigue following resolution of the acute illness.

Teach parents of young children about the risk of the development of aspiration pneumonia. Parents need to understand that the child might be at risk for injury related to their age and developmental stage. To prevent recurrent or further aspiration, teach the parents the safety measures in Teaching Guidelines 40.3.

Preventing Pneumococcal Infection

Provide immunization to children at high risk for severe pneumococcal infection. This includes all children between 0 and 23 months of age, as well as children between 24 and 59 months of age who either never received the vaccine before age 2 or did not receive a booster dose between 12 and 23 months of age.

TEACHING GUIDELINES 40.3 Preventing Aspiration

- Keep toxic substances such as lighter fluid, solvents, and hydrocarbons out of reach of young children. Toddlers and preschoolers cannot distinguish safe from unsafe fluids due to their developmental stage.
- Avoid oily nose drops and oil-based vitamins or home remedies to avoid lipid aspiration into the lungs.
- Avoid oral feedings if the infant's respiratory rate is 60 or greater to minimize the risk of aspiration of the feeding.
- Discourage parents from "force-feeding" in the event of poor oral intake or severe illness to minimize the risk of aspiration of the feeding.
- Position infants and ill children on their right side after feeding to minimize the risk of aspirating emesis or regurgitated feeding.

In addition, children between 24 and 59 months of age with certain conditions such as immune deficiency, sickle cell disease, asplenia, chronic cardiac conditions, chronic lung problems, cerebrospinal fluid leaks, chronic renal insufficiency, diabetes mellitus, and organ transplants should receive the vaccine (CDC, 2023a). For additional information on immunization, refer to Chapter 31.

Bronchitis

Bronchitis is an inflammation of the trachea and major bronchi. It is often associated with a URI. Bronchitis is usually viral in nature, although *M. pneumoniae* and other bacterial organisms are causative in about 10% of cases (Carolan, 2023). Recovery usually occurs within 5 to 10 days. Therapeutic management involves mainly supportive care. Expectorant administration and adequate hydration are important. If bacterial infection is the cause, antibiotics are indicated.

Nursing Assessment

Ascertain the history, which usually begins with a mild URI. Note development of fever, followed by a dry, hacking cough that might become productive in older children. Determine if the cough wakes the child at night. Auscultate the lungs to determine if coarse rales are present. Note that respirations remain unlabored. The chest radiograph might show diffuse alveolar hyperinflation and perihilar markings.

Nursing Management

Nursing management is aimed at providing supportive care. Teach parents that expectorants will help loosen secretions and that antipyretics will help reduce the fever, making the child more comfortable. Encourage adequate hydration. Inform parents that antibiotics are prescribed only in cases believed to be bacterial in nature (infrequent). Discourage the use of cough suppressants: it is important for accumulated sputum to be raised.

Tuberculosis

Tuberculosis (TB) is a highly contagious disease caused by inhalation of droplets of *Mycobacterium tuberculosis* or *Mycobacterium bovis*. Children usually contract the disease from an immediate household member. Children who are unhoused or living in poverty are at higher risk, as are those exposed to an adult with TB infection (Batra & Ang, 2022). After exposure to an infected individual, the incubation period is 2 to 10 weeks. The inhaled tubercle bacilli multiply in the alveoli and alveolar ducts, forming an inflammatory exudate. The bacilli are spread by the bloodstream and lymphatic system to various parts of the body. Although pulmonary TB is the most common, children may also have infection in other parts of the body, such as the gastrointestinal tract or central nervous system. Children who test positive for TB but who do not have symptoms or radiographic/laboratory evidence of disease are considered to have latent infection.

In the case of drug-sensitive TB, the American Academy of Pediatrics (AAP) recommends a 4-month course of oral therapy. In the first 2 months isoniazid, rifampin, pyrazinamide, and ethambutol are given daily. This is followed by twice-weekly isoniazid and rifampin; administration must be observed directly (usually by a public health nurse). In the case of multidrug-resistant TB, a TB specialist is consulted, and intramuscular injection may be given (Kimberlin et al., 2021). Children with latent TB are treated with isoniazid or other drugs for 9 months to prevent progression to active disease. See Healthy People 2030 box.

Nursing Assessment

Children considered to be at high risk for contracting TB should be screened using the Mantoux test. High-risk children are those who:

- are infected with human immunodeficiency virus (HIV)
- are incarcerated or institutionalized
- have a positive recent history of latent TB infection
- are immigrants from or have a history of travel to endemic countries
- are exposed at home to people living with HIV, unhoused individuals, people who use illicit drugs, people who were recently incarcerated, migrant farm workers, or nursing home residents

HEALTHY PEOPLE 2030

Objective	Nursing Significance
Reduce tuberculosis.	• Assess the health history of all infants, children, and adolescents for risk factors for tuberculosis infection. • Provide tuberculosis screening as recommended. • Refer all tuberculosis infections to the local public health department. • Educate families about the importance of completing medication therapy as prescribed for active and latent tuberculosis and the need for appropriate follow-up and retesting for tuberculosis infection.

Healthy People Objectives retrieved from http://www.healthypeople.gov

Evaluate the health history for symptoms such as fever, malaise, weight loss, anorexia, pain and tightness in the chest, and rarely hemoptysis. Note whether cough is present or not, and if present, whether it has progressed slowly over several weeks to months. As TB progresses, note an increase in respiratory rate, diminished breath sounds and crackles with poor aeration in the affected lung. Percussion may reveal dullness. Keep in mind that some children are asymptomatic. Diagnosis is confirmed with a positive Mantoux test, positive gastric washings for acid-fast bacillus, interferon-gamma release assay (IGRA), and/or a chest radiograph consistent with TB.

Nursing Management

Hospitalization of children with TB is necessary only for the most serious cases. Nursing management is aimed at providing supportive care and encouraging adherence to the treatment regimen. Most nursing care for childhood TB is provided in outpatient clinics, schools, or a public health setting. Supportive care includes ensuring adequate nutrition and adequate rest, providing comfort measures such as fever reduction, preventing exposure to other infectious diseases, and preventing reinfection. Isolate hospitalized children with TB according to hospital policy to prevent nosocomial spread of TB infection.

TAKE NOTE!

Administration of Bacille Calmette–Guérin (BCG) vaccine can provide incomplete protection against TB, and it is not widely used in the United States (Kimberlin et al., 2021).

COVID-19

URI have long been known to be caused by the *Coronaviridae* family of viruses, among many others. In 2020, COVID-19 quickly spread worldwide, causing significant morbidity and mortality, particularly in certain populations (S. Smith, 2022). COVID-19 infection may be mild, lead to respiratory failure, or result in multisystem inflammatory syndrome (MIS-C) 4 to 6 weeks after an initial mild or unidentified infection (Zachariah, 2022). During the COVID-19 pandemic, a vaccine was made available, first to older adults or those vulnerable to severe infection, later to all adults, then, finally, to children as young as 6 months of age. The CDC recommends that every person 6 months of age and older receive the updated COVID-19 vaccine (2024).

Quarantines were implemented nationwide (and across most parts of the world) in early 2020 as a result of the quickly increasing morbidity and mortality rates. Quarantines resulted in job and income losses for some adults and lack of socialization for children who were unable to attend day care or school. As the COVID-19 pandemic has eased, morbidity and mortality rates have decreased significantly. Thus, quarantines and social distancing requirements have been lifted, and people have returned to work and school as they did prior to the pandemic. In 2023, some states still required certain populations (e.g., those who work in health care and/or certain state agencies) to either be vaccinated against COVID-19 or to submit to regular testing for the virus (Markowitz & Rough, 2024).

Nursing Assessment

About 50% of children infected with the COVID-19 virus are asymptomatic. Evaluate the health history for symptoms such as fever (may or may not be present), cough, runny nose, sore throat, nausea, vomiting, or diarrhea. The infected infant may be apneic, and the older child or adolescent may experience loss of smell and taste. Headache may be present in the older child. Determine the child's immunization status.

Nursing Management

Provide supportive care to the child with mild COVID-19 infection. Antipyretics and symptomatic relief of other clinical manifestations will make the child more comfortable. Educate families about proper hand hygiene, as well as social distancing (6 ft apart) and the proper use of masks if the child is 2 years of age or older (Rabinowicz et al., 2020). Refer families to the World Health Organization's (2021) website of updated COVID-19 information for the public at this link: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters.

ACUTE NONINFECTIOUS DISORDERS

Acute noninfectious disorders include epistaxis, foreign body aspiration, acute respiratory distress syndrome (ARDS), and pneumothorax.

Epistaxis

Epistaxis (a nosebleed) occurs most frequently in children before adolescence. Bleeding of the nasal mucosa occurs most often from the anterior portion of the septum. Epistaxis may be recurrent and idiopathic (meaning there is no cause). Most cases are benign, but in children with bleeding disorders or other hematologic concerns, epistaxis should be further investigated and treated.

Nursing Assessment

Explore the child's history for initiating factors such as local inflammation, mucosal drying, or local trauma (usually nose picking). Inspect the nasal cavity for blood.

Nursing Management

Remain calm and encourage the parents to do so as well since the presence of blood often frightens children and their parents. Have the child sit up and lean forward (lying down may allow aspiration of the blood). Apply continuous pressure to the anterior portion of the nose by pinching it closed. Encourage the child to breathe through the mouth during this portion of the treatment. Ice or a cold cloth applied to the bridge of the nose may also be helpful. The bleeding usually stops within 10 to 15 minutes. Apply water-soluble gel to the nasal mucosa with a cotton-tipped applicator to moisten the mucosa and prevent recurrence.

CLINICAL REASONING ALERT!

The child with recurrent epistaxis or epistaxis that is difficult to control should be further evaluated for underlying bleeding or platelet concerns.

Foreign Body Aspiration

Foreign body aspiration occurs when any solid or liquid substance is inhaled into the respiratory tract. It is common in infants and young children and can present in a life-threatening manner. The object may lodge in the upper or lower airway, causing varying degrees of respiratory difficulty. Small, smooth objects such as peanuts are the most frequently aspirated, but any small toy, article, or piece of food smaller than the diameter of the young child's airway can be aspirated.

TAKE NOTE!

Items smaller than 1.25 in (3.2 cm) can be aspirated easily. A simple way for parents to estimate the safe size of a small item or toy piece is to gauge its size against a standard toilet paper roll (not double roll), which is generally about 1.5 in in diameter.

Foreign body aspiration occurs most frequently in children between 6 months and 3 years of age (Houin et al., 2022). Children this age are growing and developing rapidly. They tend to explore things with their mouths and can easily aspirate small items.

The child often coughs out foreign bodies from the upper airway. If the foreign body reaches the bronchus, then it may need to be surgically removed via bronchoscopy. Postoperative antibiotics are used if an infection is also present. Complications of foreign body aspiration include pneumonia or abscess formation, hypoxia, respiratory failure, and death.

Nursing Assessment

Evaluate the history of the infant or young child for usually sudden onset of cough, wheeze, or stridor, although the onset of respiratory symptoms can be more gradual. Stridor suggests that the foreign body is lodged in the upper airway. Auscultate the lungs for wheezing, rhonchi, and decreased aeration (can be heard on the affected side). A chest radiograph will demonstrate the foreign body only if it is radiopaque (Fig. 40.7).

Nursing Management

The most important nursing intervention related to foreign body aspiration is prevention. Anticipatory guidance for families with 6-month-olds should include a discussion of aspiration avoidance. Repeat this information at each subsequent well-child visit through age 5. Tell parents to avoid letting their child play with toys with small parts and to keep coins and other small objects

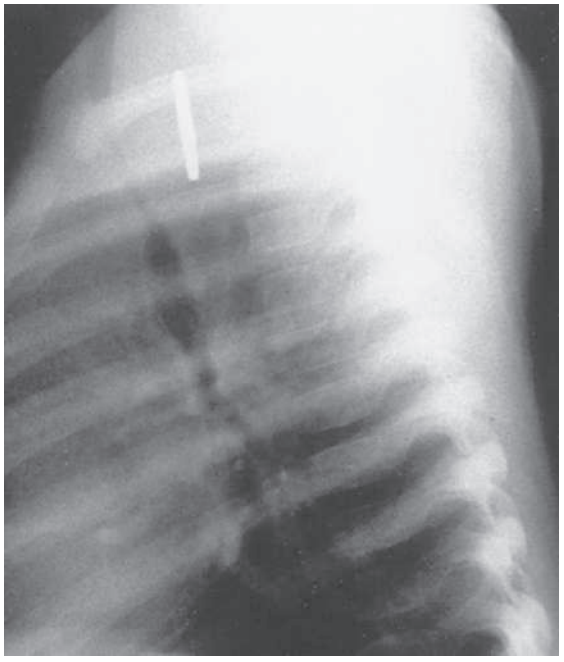


FIGURE 40.7 Foreign body is noted in the bronchus on a chest radiograph.

out of the reach of children. Teach parents not to feed peanuts and popcorn to their child until they are at least 4 years old (Durani, 2023). When children progress to table food, teach parents to chop all foods so that they are small enough to pass down the trachea should the child neglect to chew them up thoroughly. Carrots, grapes, and hot dogs should be cut into small pieces. Harmful liquids should be kept out of the reach of children.

TAKE NOTE!

Prevent young children from playing with latex balloons. When popped, small pieces pose an aspiration danger (Durani, 2023).

Acute Respiratory Distress Syndrome

ARDS occurs following a primary insult such as sepsis, infectious or aspiration pneumonia, or COVID-19 in infants and children with previously healthy lungs (Purohit et al., 2023; Zachariah, 2022). The alveolar–capillary membrane becomes more permeable, and pulmonary edema develops. Hyaline membrane formation over the alveolar surfaces and decreased surfactant production cause lung stiffness. Mucosal swelling and cellular debris lead to atelectasis. Gas diffusion is impaired significantly. Some children have residual lung disease, and some recover completely. However, ARDS can progress to respiratory failure and death.

Therapeutic management is aimed at improving oxygenation and ventilation. Mechanical ventilation is used, with special attention to lung volumes and positive end-expiratory pressure (PEEP). Newer treatment modalities show promise for improving outcomes of ARDS.

Nursing Assessment

Note tachycardia and tachypnea occurring over the first few hours of the illness. Observe for significantly increased work of breathing, nasal flaring, and retractions. Auscultate the breath sounds, which might range from normal to high-pitched crackles throughout the lung fields. Note decreased oxygen saturation. Bilateral infiltrates can be seen on a chest radiograph.

Nursing Management

Nursing care of the child with ARDS is mainly supportive and occurs in the intensive care unit. Closely monitor respiratory and cardiovascular status. Comfort measures such as hygiene and positioning as well as pain and anxiety management, maintenance of nutrition, and prevention of infection are also key nursing interventions. Soothe the child's fears as the acute phase of worsening respiratory distress can be frightening for a child of any age. As the disease worsens and progresses, especially when ventilatory support is required, it is especially important to provide psychological support of the family as well as education about the intensive care unit procedures.

Pneumothorax

A collection of air in the pleural space is called a pneumothorax. It can occur spontaneously in an otherwise healthy child or as a result of chronic lung disease, cardiopulmonary resuscitation (CPR), surgery, or trauma. Trapped air consumes space within the pleural cavity, and the affected lung suffers at least partial collapse. Needle aspiration and/or placement of a chest tube are used to evacuate the air from the chest. Some small pneumothoraces resolve independently, without intervention.

Nursing Assessment

The infant or child with a pneumothorax might have a sudden or gradual onset of symptoms. Determine risk factors for acquiring a pneumothorax, including chest trauma or surgery, intubation and mechanical ventilation, or a history of chronic lung disease such as cystic fibrosis. Note the presence of chest pain, tachypnea, retractions, nasal flaring, grunting, pallor, or cyanosis. Auscultate for tachycardia and absent or diminished breath sounds on the affected side. The radiograph reveals air within the thoracic cavity (Fig. 40.8).

Nursing Management

Frequently assess the child's respiratory status. Administer 100% oxygen as ordered as it hastens the reabsorption of air (generally used only for a few hours) (Janahi, 2024). Assist with needle aspiration and/or chest tube insertion. If a chest tube is connected to a dry suction or water seal apparatus, provide care of the drainage apparatus as appropriate (Fig. 40.9). Keep a pair of hemostats at the bedside to clamp the tube should it become dislodged from the drainage container, or the open end may be placed in a container of sterile water. The dressing around the chest tube is occlusive and is not routinely changed. If the tube becomes dislodged from the child's chest, apply Vaseline gauze and an occlusive dressing, immediately perform appropriate respiratory assessment, and notify the primary provider or nurse practitioner.

CHRONIC RESPIRATORY DISORDERS

Chronic respiratory disorders include allergic rhinitis, asthma, chronic lung disease (bronchopulmonary dysplasia), cystic fibrosis, and apnea.

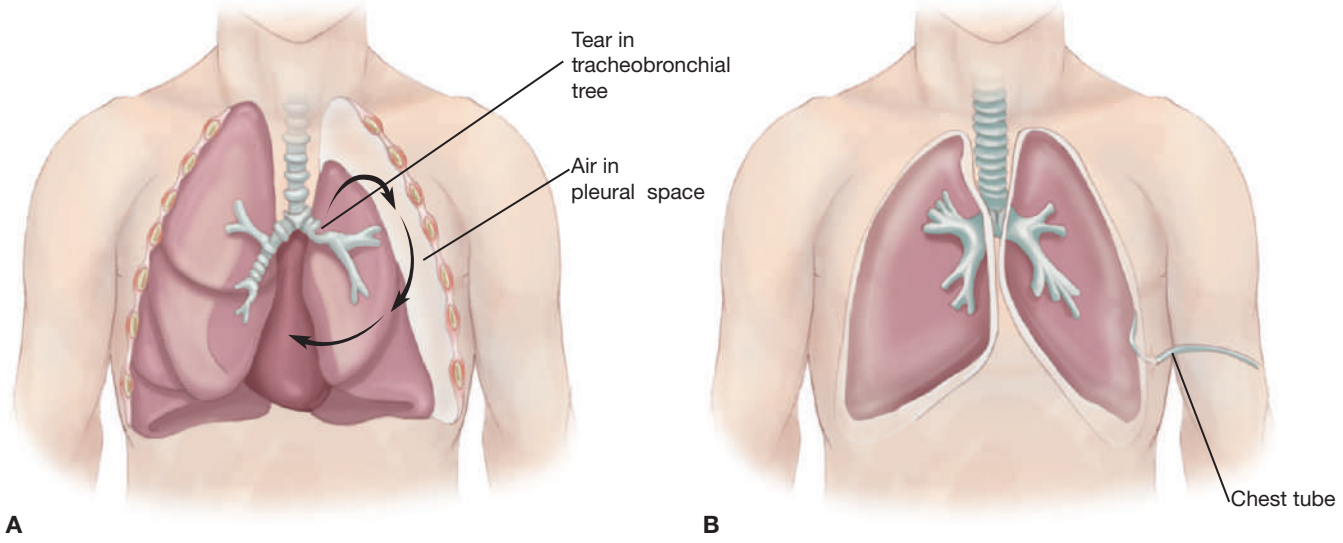


FIGURE 40.8 **A.** Pneumothorax. **B.** Note reinflation of the lung when the chest tube is present.

Allergic Rhinitis

Allergic rhinitis is a common chronic condition in childhood, affecting a significant number of children. Allergic rhinitis is associated with atopic dermatitis and asthma. Perennial allergic rhinitis occurs year-round and is associated with indoor environments. Allergens commonly implicated in perennial allergic rhinitis include dust mites, pet dander, cockroach antigens, and molds. Seasonal allergic rhinitis is caused by elevations in outdoor levels of allergens. It is typically caused by certain pollens, trees, weeds, fungi, and molds. Complications from allergic rhinitis include exacerbation of asthma symptoms, recurrent sinusitis and otitis media, and dental malocclusion.

Pathophysiology

Allergic rhinitis is an intermittent or persistent inflammatory state that is mediated by immunoglobulin E (IgE). In response to contact with an airborne allergen protein, the nasal mucosa mounts an immune response. The antigen (from the allergen) binds to a specific IgE on the surface of mast cells, releasing the chemical mediators of histamine and leukotrienes. Shortly thereafter, various white blood cells release chemical mediators, and inflammation results. IgE binds to receptors on the surfaces of mast cells and basophils, creating the sensitization memory that causes the reaction with subsequent allergen exposures. Allergen exposure then results in the inflammatory response. Histamine and other factors cause nasal vasodilation, watery **rhinorrhea** (runny nose), nasal congestion, pruritus, and sneezing. Treatment of allergic rhinitis is aimed at decreasing response to these allergic mediators as well as treating inflammation.

FIGURE 40.9 The chest tube is connected to a suction or water seal via a drainage container.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter. Assessment findings pertinent to allergic rhinitis are discussed further on.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Mild, intermittent, to chronic nasal stuffiness
- Thin, runny nasal discharge
- Sneezing
- Itching of nose, eyes, palate
- Mouth breathing and snoring

Determine the seasonality of symptoms. Are they perennial (year-round) or do they occur during certain seasons only? What types of medications or other treatments have been used, and what was the child's response?

Explore the history for the presence of risk factors such as:

- Family history of atopic disease (asthma, allergic rhinitis, or atopic dermatitis)
- Known allergy to dust mites, pet dander, cockroach antigens, pollens, or molds
- Early childhood exposure to indoor allergens
- Early introduction to foods or formula in infancy
- Exposure to tobacco smoke

Physical Examination

Physical examination of the child with allergic rhinitis includes inspection, observation, and auscultation.

INSPECTION AND OBSERVATION

Observe the child's facies for red-rimmed eyes or tearing, mild eyelid edema, "allergic shiners" (bluish or grayish cast beneath the eyes), and "allergic salute" (a transverse nasal crease between the lower and middle thirds of the nose that results from repeated nose rubbing) (Fig. 40.10). Inspect the nasal cavity. The turbinates may be swollen and gray/blue. Clear mucoid nasal drainage may be observed. Inspect the skin for rash. Listen for nasal phonation with speech.

FIGURE 40.10 Allergic shiners beneath the eyes and allergic salute across the nose.

AUSCULTATION

Auscultate the lungs for adequate aeration and clarity of breath sounds. In the child who also has asthma, exacerbation with wheezing often occurs with allergic rhinitis.

Laboratory and Diagnostic Tests

The initial diagnosis is often made based on the history and clinical findings. Common laboratory and diagnostic studies ordered for the assessment of allergic rhinitis may include:

- Nasal smear (positive for eosinophilia)
- Positive allergy skin test
- Positive radioallergosorbent test (RAST)

To distinguish between the causes of nasal congestion, refer to Comparison Chart 40.1.

Nursing Management

In addition to the patient problems and related interventions discussed in the "Clinical Judgment and the Nursing Process" section earlier in the chapter, interventions common to allergic rhinitis follow.

Maintaining Patent Airway

Perform nasal washes with normal saline to keep the nasal mucus from becoming thickened and to lessen nasal obstruction. Thickened, immobile secretions often lead to a secondary bacterial infection. The nasal wash also decongests the nose, allowing for improved nasal airflow. Administer antiinflammatory (corticosteroid) nasal sprays as prescribed to decrease the inflammatory response to allergens and/or mast cell stabilizing nasal spray such as cromolyn sodium to decrease the intensity and frequency of allergic responses. Teach families about nasal medications as well as other recommended drugs such as once-daily oral antihistamines, combined antihistamine/nasal decongestants, or leukotriene modifiers such as montelukast. See Dosage Calculation Box 40.1.

DOSAGE CALCULATION BOX 40.1

Child's weight: 30 lb

Medication order: cetirizine 2.5 mg PO every morning.

Cetirizine is supplied as 5 mg/5 mL.

How many milliliters will the nurse administer? Round to the nearest tenth.

Providing Family Education

One of the most important tools in the treatment of allergic rhinitis is learning to avoid known allergens. Teaching Guidelines 40.4 gives information on educating families

TEACHING GUIDELINES 40.4 Controlling Exposure to Allergens

Tobacco
- Avoid all exposure to tobacco smoke.
- No parental smoking inside the home or car.

Dust Mites
- Use pillow and mattress covers.
- Wash bed linens once a week in 130°F water.
- Use blinds rather than curtains in bedroom.
- Remove stuffed animals from bedroom, or minimize number and wash weekly.
- Reduce indoor humidity to <50%.
- Remove carpet from bedroom.
- Clean solid-surface floors with wet mop each week.

Pet Dander
- Remove pets from home permanently.
- If unable to remove them, keep them out of bedroom and off carpet and upholstered furniture.

Cockroaches
- Keep kitchen very clean.
- Avoiding leaving food or drinks out.
- Use pesticides if necessary, but ensure that the asthmatic child is not inside the home when the pesticide is sprayed.

Indoor Molds
- Repair water leaks.
- Use dehumidifier to keep basement dry.
- Reduce indoor humidity to <50%.

Outdoor Molds, Pollen, and Air Pollution
- Avoid going outdoors when mold and pollen counts are high.
- Avoid outdoor activity when pollution levels are high.

Adapted from Houin, P., Stillwell, P., Deboer, E. M., & Hoppe, J. (2022). Respiratory tract & mediastinum. In M. Bunik, W. W. Hay, M. J. Levin, & M. J. Abzug (Eds.), *Current diagnosis and treatment: Pediatrics* (26th ed.). McGraw-Hill Education; Volkman, K. K., & Chiu, A. M. (2023). Allergy. In K. J. Marcdante, & R. M. Kliegman (Eds.), *Nelson's essentials of pediatrics* (9th ed.). Elsevier.

about avoidance of allergens. Children may be referred to a specialist for allergen desensitization (allergy shots). Products helpful with control of allergies are available from a number of vendors.

Asthma

Asthma is a chronic inflammatory airway disorder characterized by airway hyperresponsiveness, airway edema, and mucus production. Airway obstruction resulting from asthma might be partially or completely reversed. Severity ranges from long periods of control with infrequent acute exacerbations in some children to the presence of persistent daily symptoms in others. It is the most common chronic illness of childhood, with 7 million American children diagnosed before age 18 years (Volkman & Chiu, 2023). The incidence and severity of asthma are increasing; this might be attributed to increased urbanization, increased air pollution, and more accurate diagnosis. See Healthy People 2030.

HEALTHY PEOPLE 2030

Objective	Nursing Significance
Reduce asthma deaths, hospitalizations for asthma, hospital emergency department visits for asthma.	• Appropriately educate children with asthma and their families about the ongoing management of asthma. • Provide appropriate education and triage to families of children with asthma, particularly when the child is experiencing symptoms or a decreased peak flow rate.

Healthy People Objectives retrieved from http://www.healthypeople.gov

Severity ranges from symptoms associated only with vigorous activity (exercise-induced bronchospasm) to daily symptoms that interfere with quality of life (such as severe persistent asthma resulting in nighttime symptoms occurring every day). Although uncommon, childhood death related to asthma is also on the rise worldwide. Many children with asthma also have gastroesophageal disease, although the relationship between the two diseases is not clearly understood. Children with asthma are more susceptible to serious bacterial and viral respiratory infections. Acute complications include status asthmaticus and respiratory failure.

PATHOPHYSIOLOGY

In asthma, the inflammatory process contributes to increased airway activity. Thus, control or prevention of inflammation is the core of asthma management. Asthma results from a complex variety of responses in relation to a trigger. When the process begins, mast cells, T lymphocytes, macrophages, and epithelial cells are involved in the release of inflammatory mediators. Eosinophils and neutrophils migrate to the airway, causing injury. Chemical mediators such as leukotrienes, bradykinin, histamine, and platelet-activating factor also contribute to the inflammatory response. The presence of leukotrienes contributes to prolonged airway constriction. Autonomic neural control of airway tone is affected, airway mucus secretion is increased, mucociliary function changes, and airway smooth muscle responsiveness increases. As a result, acute bronchoconstriction, airway edema, and mucus plugging occur (Fig. 40.11).

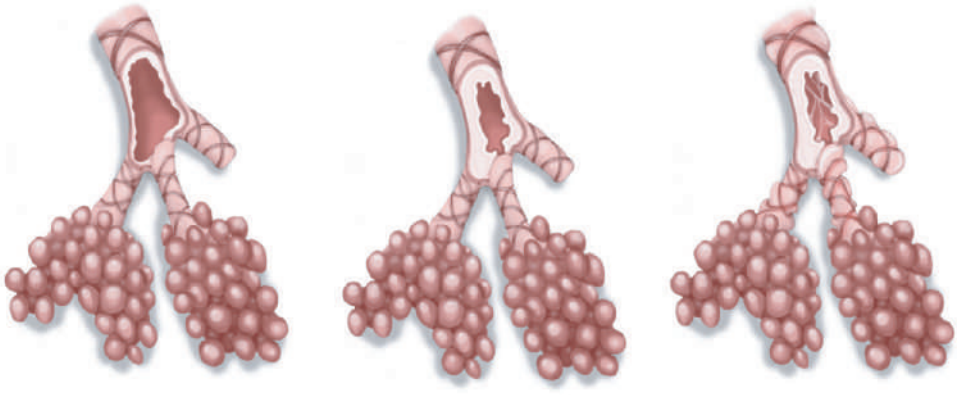


FIGURE 40.11 Note airway edema, mucus production, and bronchospasm occurring with asthma.

In most children, this process is considered reversible, and until recently it was not considered to have long-standing effects on lung function. Current research and scientific thought, however, recognize the concept of airway remodeling as a significant long-term complication. Over time, with repeat asthma exacerbations, irreversible structural airway changes occur, and pulmonary function decreases with this remodeling (Volkman & Chiu, 2023). In some individuals with poorly controlled asthma, these changes may be permanent, resulting in decreased responsiveness to therapy.

Therapeutic Management

Current goals of medical therapy are avoidance of asthma triggers and reduction or control of inflammatory episodes. The most recent recommendations by the National Asthma Education and Prevention Program (NAEPP) and the Global Initiative for Asthma (GINA) suggest a stepwise approach to medication management as well as control of environmental factors (allergens) and comorbid conditions that affect asthma. The NAEPP and GINA guidelines stress periodic assessment of asthma control. Treatment decisions may then be made based on the individual's level of asthma control, rather than on the severity at diagnosis.

The stepwise approach to asthma treatment involves increasing medications as the child's condition worsens, then backing off treatment as they improve (Box 40.3).

Short-acting bronchodilators may be used in the acute treatment of bronchoconstriction, and long-acting forms may be used to prevent bronchospasm. Exercise-induced bronchospasm may occur in any child with asthma or as the only symptom in the child with mild intermittent asthma. Most children may avoid exercise-induced bronchospasm by using a longer warm-up period prior to vigorous exercise and, if necessary, inhaling a short-acting bronchodilator just prior to exercise. Long-term prevention usually involves inhaled steroids. Leukotriene modifiers may be used as an alternative but are not preferred for mild persistent asthma (Covar et al., 2022).

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter. Assessment findings pertinent to asthma are discussed further on.

BOX 40.3 Stepwise Approach to Asthma Management

All children: child education, environmental control, and management of comorbidities at each step. Consider referral to asthma specialist at step 3. (Step 2 and above are persistent asthma.)

Step 1 (intermittent asthma)
- Preferred: short-acting beta-2 agonist PRN

Step 2
- Preferred: low-dose inhaled corticosteroid
- Alternative: cromolyn or leukotriene modifier

Step 3
- Preferred: medium-dose inhaled corticosteroid (all ages) OR low-dose inhaled corticosteroid and leukotriene modifier or long-acting beta-2 agonist (children older than 4 years)

Step 4
- Preferred: medium-dose inhaled corticosteroids and long-acting beta-2 agonist (can use leukotriene modifier in children younger than 4 years)

Step 5
- Preferred: high-dose inhaled corticosteroids and long-acting beta-2 agonist (or leukotriene modifier or theophylline)

Step 6
- Preferred: high-dose inhaled corticosteroids, long-acting beta-2 agonist, and oral systemic corticosteroids

Adapted from Houin, P., Stillwell, P., Deboer, E. M., & Hoppe, J. (2022). Respiratory tract & mediastinum. In M. Bunik, W. W. Hay, M. J. Levin, & M. J. Abzug (Eds.), *Current diagnosis and treatment: Pediatrics* (26th ed.). McGraw-Hill Education; Volkman, K. K., & Chiu, A. M. (2023). Allergy. In K. J. Marcdante, & R. M. Kliegman (Eds.), *Nelson's essentials of pediatrics* (9th ed.). Elsevier.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Cough, particularly at night: hacking cough that is initially nonproductive, becoming productive of frothy sputum
- Difficulty breathing: shortness of breath, chest tightness or pain, dyspnea with exercise
- Wheezing

Explore the child's current and past medical history for risk factors such as:

- History of allergic rhinitis or atopic dermatitis
- Family history of atopy (asthma, allergic rhinitis, atopic dermatitis)
- Recurrent episodes diagnosed as wheezing, bronchiolitis, or bronchitis
- Known allergies
- Seasonal response to environmental pollen
- Tobacco smoke exposure
- Poverty

Physical Examination

Physical examination of the child with asthma includes inspection, auscultation, and percussion.

INSPECTION

Observe the child's general appearance and color. During mild exacerbations, the child's color might remain pink, but as the child worsens, cyanosis might result. Assess work of breathing, which is variable, ranging from mild retractions to significant accessory muscle use and eventually head bobbing if not treated effectively. Note lethargy, irritability, or the appearance of anxiety or fearfulness. An audible wheeze might be present. Children with persistent severe asthma may have a barrel chest and routinely demonstrate mildly increased work of breathing.

AUSCULTATION AND PERCUSSION

A thorough assessment of lung fields is necessary. Wheezing is the hallmark of airway obstruction and might vary throughout the lung fields. Coarseness might also be present. Assess the adequacy of aeration. Breath sounds might be diminished in the bases or throughout. A quiet chest in an asthmatic child can be an ominous sign. With severe airway obstruction, air movement can be so poor that wheezes might not be heard on auscultation. Percussion may yield hyperresonance.

Laboratory and Diagnostic Tests

Laboratory and diagnostic studies commonly ordered for the assessment of asthma include:

- Pulse oximetry: oxygen saturation may be decreased significantly or normal during a mild exacerbation.
- Chest radiograph: usually reveals hyperinflation.
- Blood gases: might show carbon dioxide retention and hypoxemia.
- Pulmonary function tests (PFTs): can be very useful in determining the degree of disease but are not useful during an acute attack. Children as young as 5 to 6 years might be able to comply with spirometry.
- Peak expiratory flow rate (PEFR): is decreased during an exacerbation.
- Allergy testing: skin test or RAST can determine allergic triggers for the asthmatic child.

Nursing Management

Initial nursing management of the child with an acute exacerbation of asthma is aimed at restoring a clear airway and effective breathing pattern as well as promoting adequate oxygenation and ventilation (gas exchange). Ongoing management focuses on adherence to the maintenance treatment plan and supporting the child and family. Refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter for suggested nursing patient problems and interventions. Additional specific considerations are reviewed further on.

• • • ATRAUMATIC CARE • • •

When caring for a young child who must receive a nebulizer treatment by mask, play make-believe about the mask, and utilize other distraction techniques such as reading a book. Making activities into games and utilizing distraction both help to minimize trauma when providing necessary care to young children.

Educating the Child and Family

Teach families of children with asthma, and the children themselves, how to care for the disease; they need to understand the chronicity of asthma. Help families to understand that symptom-free periods (often very long) are interspersed with episodes of exacerbation. Educate parents and children about the importance of maintenance medications for long-term control. Teach them that the episodes of exacerbation (sometimes requiring hospitalization or emergency room visits) should not be viewed as an acute illness. While parents may be relieved when an episode resolves, they should not view the child as disease-free during the periods between acute episodes. Educate families that the long-term maintenance schedules must be maintained during those periods as well. Inform families that the prolonged inflammatory process occurring in the

absence of symptoms, primarily in children with moderate to severe asthma, can lead to airway remodeling and eventual irreversible disease.

Educate the child and family about the management plan in place to determine when to step up or step down treatment. Figure 40.12 provides an example of an action plan that may be helpful to families in the management of asthma. Instruct parents to ensure the action plan is kept on file at the child's school and that relief medication is always available to the child. Children who experience exercise-induced bronchospasm may still participate in physical education or athletics but may need to be allowed to use their medicine before the activity. Provide appropriate education to the child and family based on the child's individualized stepwise treatment plan. Stress the concept of maintenance medications for the prevention of future serious disease in addition to controlling or preventing current symptoms.

Educate families and children on the appropriate use of nebulizers, metered-dose inhalers, spacers, dry-powder inhalers, and Diskus, as well as the purposes, functions, and side effects of the medications they deliver. Require return demonstrations of equipment use to ensure that children and families can use the equipment properly (Teaching Guidelines 40.5).

TAKE NOTE!

It is recommended to use an age-appropriate spacer or holding chamber with metered-dose inhalers to increase the bioavailability of medication in the lungs (Volkman & Chiu, 2023).

In children who have more severe asthma, the use of the PEFR helps to determine daily control. PEFR measurements obtained via a home peak flow meter can be very helpful if the meter is used appropriately (Volkman & Chiu, 2023). Teaching Guidelines 40.6 gives instructions on peak flow meter use. The child's "personal best" is determined collaboratively with the primary provider or nurse practitioner during a symptom-free period. PEFR is measured daily at home using the peak flow meter. The

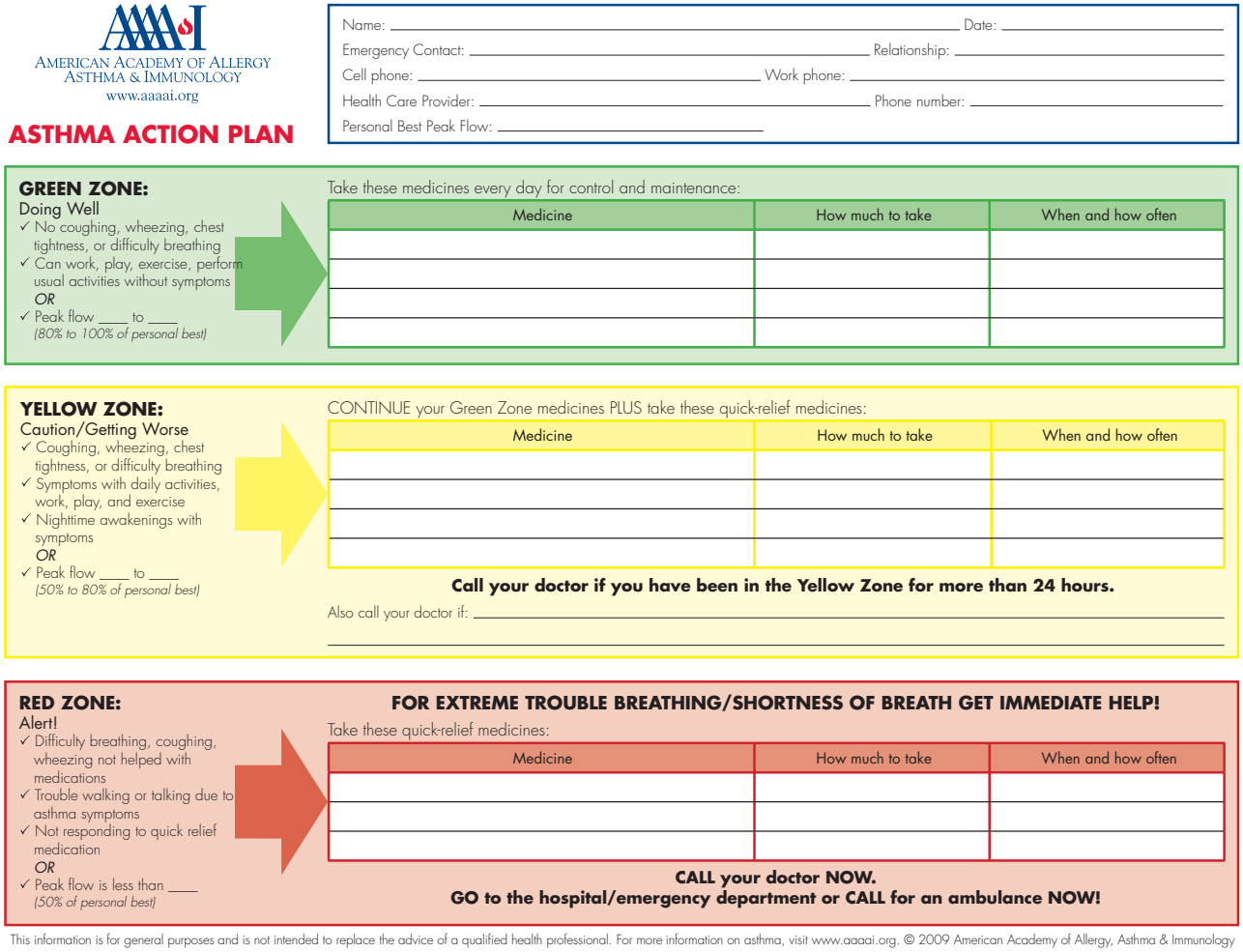
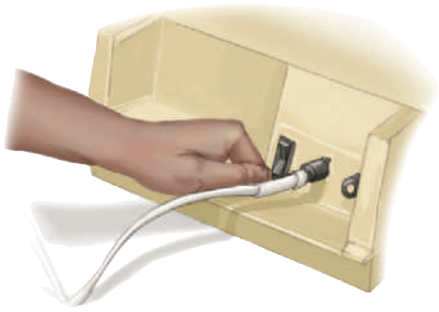


FIGURE 40.12 Asthma action plan. (Used with permission from the American Academy of Allergy, Asthma & Immunology. [2011]. *Asthma action plan*. http://www.aaaai.org/professionals/asthma-action-plan.pdf. Visit AAAAI.org for additional information and updates.)

TEACHING GUIDELINES 40.5 Using Asthma Medication Delivery Devices

Nebulizer

1. Plug in the nebulizer and connect the air compressor tubing.



2. Add the medication to the medicine cup.

3. Attach the mask or the mouthpiece and hose to the medicine cup.

4. Place the mask on the child or (see step 5).

5. Instruct the child to close the lips around the mouthpiece and breathe through the mouth.

6. After use, wash the mouthpiece and medicine cup with water and allow to air dry.

Metered-Dose Inhaler

1. Shake the inhaler and take off the cap.

2. Attach the inhaler to the spacer or holding chamber.
3. Breathe out completely.

(*continued*)

TEACHING GUIDELINES 40.5 Using Asthma Medication Delivery Devices (*continued*)

4. Put the spacer mouthpiece in the mouth (or place the mask over the child's nose and mouth, ensuring a good seal).

5. Compress the inhaler and inhale slowly and deeply. Hold the breath for a count of 10.
6. Wait one full minute before second inhalation, if prescribed.

Diskus

1. Hold the Diskus in a horizontal position in one hand and push the thumb grip with the thumb of your other hand away from you until the mouthpiece is exposed.

2. Push the lever until it clicks (the dose is now loaded).
3. Breathe out fully.

4. Place your mouth securely around the mouthpiece and then inhale.

5. Remove the Diskus, hold the breath for 10 seconds, and then breathe out.

Turbuhaler

1. Hold the Turbuhaler upright. Load the dose by twisting the brown grip fully to the right.

2. Then twist it to the left until you hear it click.
3. Breathe out fully.

4. Holding the Turbuhaler horizontally, place the mouth firmly around the mouthpiece and inhale deeply and forcefully.

5. Remove the Turbuhaler from the mouth and then breathe out.

TEACHING GUIDELINES 40.6 Using a Peak Flow Meter

- Slide the arrow down to "zero."
- Stand up straight.
- Take a deep breath and close the lips tightly around the mouthpiece.
- Blow out hard and fast.
- Note the number the arrow moves to.
- Repeat three times and record the highest reading.
- Keep a record of daily readings, being sure to measure peak flow at the same time each day.

Adapted from Gerald, L. B., & Carr, T. (2022). Patient education: How to use a peak flow meter (beyond the basics). *UpToDate.* Retrieved March 11, 2024, from https://www.uptodate.com/contents/how-to-use-a-peak-flow-meter-beyond-the-basics

asthma management plan then gives specific instructions based on the PEFR measurement (Table 40.2).

TAKE NOTE!

Young children with asthma receiving inhaled medications via a nebulizer should use a snugly fitting mask to ensure accurate deposition of medication to the lungs and reduce loss of medication to the ambient air (Volkman & Chiu, 2023).

Avoidance of allergens is another key component of asthma management. Avoiding known triggers helps to prevent exacerbations as well as long-term inflammatory changes. This can be a difficult task for most families, particularly if the affected child suffers from several allergies. Refer to Teaching Guidelines 40.4 for strategies of allergen avoidance.

TAKE NOTE!

Teach the child and family that exposure to cigarette smoke increases the need for medications in children with asthma as well as the frequency of asthma exacerbations. Both indoor air quality and environmental pollution contribute to asthma in children.

Asthma education is a critical component in ensuring optimal health in children with asthma. This education is not limited to the hospital or clinic setting. Nurses can become involved in community asthma education: community-centered education in schools, churches, and day care centers or through peer educators has been shown to be effective. Education should include pathophysiology, asthma triggers, and prevention and treatment strategies. With so many children affected with this chronic disease, community education has the potential to make a broad impact.

School nurses must also become experts in asthma management as well as being committed to ongoing education of the child and family. See Evidence-Based Practice 40.1. Resources for schools include:

- Open airways for schools: an educational program presented by the American Lung Association or its local chapter, focusing on increasing asthma awareness and compliance with asthma action plans and decreasing asthma emergencies. Contact the local lung association or call 1-800-LUNG-USA.
- Indoor air repair at school: a kit available from Allergy and Asthma Network Mothers of Asthmatics (AANMA); and Healthy School Environments Assessment Tool.

Promoting the Child's Self-Esteem

The importance of education in the use of controller medications is well known, as increased use leads to decreased emergency room visits (Carey et al., 2019). In addition to quality asthma education, offer emotional support to children with asthma and their families. As children transition to assuming more control over their asthma, provide additional support for the child in their efforts and for the parent while helping them to let go a little more. Shared management of asthma care changes over time in a developmental fashion, as the child becomes more capable of taking responsibility for their own health. The school-age years are known to be a particular transition time (Sonney et al., 2019). An agreement related to asthma management being shared between the child and the parent my result in higher quality asthma control (Sonney et al., 2019). In

TABLE 40.2 • Assessment of Peak Expiratory Flow Rate (PEFR)

Zone[a]	PEFR	Symptoms	Action
Green: Good control	>80% personal best	None	Take usual medications.
Yellow: Caution	50%–80% personal best	Possibly present	Take short-acting inhaled beta$_2$-agonist right away. Talk to your primary provider or nurse practitioner.
Red: Medical alert	<50% personal best	Usually present	Take short-acting inhaled beta$_2$-agonist right away. Go to office or emergency department.

[a]The National Asthma Education and Prevention Program recommended the "traffic light" approach for educating individuals on PEFRs and management plans.

Data from Houin, P., Stillwell, P., Deboer, E. M., & Hoppe, J. (2022). Respiratory tract & mediastinum. In M. Bunik, W. W. Hay, M. J. Levin, & M. J. Abzug (Eds.), *Current diagnosis and treatment: Pediatrics* (26th ed.). McGraw-Hill Education; Volkman, K. K., & Chiu, A. M. (2023). Allergy. In K. J. Marcdante, & R. M. Kliegman (Eds.), *Nelson's essentials of pediatrics* (9th ed.). Elsevier.

EVIDENCE-BASED PRACTICE 40.1

School-Based Interventions for Asthma

STUDY

Asthma is a common respiratory condition in children and adolescents. Theoretically, acquisition of skills for self-management of asthma could occur with the school (a place where children already participate in learning). The review included 55 studies, with over 20,000 child and adolescent participants. The objectives of the review were to identify intervention features aligned with successful intervention and to determine effectiveness in school-based interventions in relation to child/adolescent asthma self-management.

Findings

Compared with no school intervention, school-based interventions mildly decreased the numbers of hospitalizations and emergency department visits for participants. In addition, the intervention may be responsible for slightly increasing the participants' quality of life.

Nursing Implications

Nurses should consider the results of this review. School nurses could implement interventions for self-management. Nurses outside of the school system have the opportunity to reinforce the self-management interventions as structured by the school.

Data from Harris, K., Kneale, D., Lasserson, T., McDonald, V. M., Grigg, J., & Thomas, J. (2019). School-based self-management interventions for asthma in children and adolescents: A mixed methods systematic review. ***Cochrane Database of Systematic Reviews.*** https://doi.org//10.1002/14651858.CD011651.pub2

addition to coping with a chronic illness, the child with asthma must often also cope with school-related issues. As compared to children without asthma, children with asthma often experience impaired sleep and participate less often in physical activity. They also experience increased stress and anxiety (Lack et al., 2020). Performing yoga increases physical activity in children with asthma and has been shown to improve lung function over time. Mindfulness training may also be beneficial, as increased mindfulness in children with asthma leads to improved quality of life as a result of increased asthma control (Lack et al., 2020).

Through education and support, the child can gain a sense of control. Children need to learn to master their disease. Accurate evaluation of asthma symptoms and improvement of self-esteem may help the child to experience less panic with an acute episode. Improved self-esteem might also help the child cope with the disease, in general, and with being different from their peers. The school-age child has the cognitive ability to begin taking responsibility for asthma management, with continued involvement on the part of the parents. Transferring control of asthma care to the child is an important developmental process that will increase the child's feeling of control over the illness.

Promoting Family Coping

Parent denial is an issue in many families. The family, through education and encouragement, can become the experts on the child's illness as well as advocates for the child's well-being. The resilient child is better able to cope with the challenges facing them, including asthma. Cohesiveness and warmth in the family environment can improve a child's resiliency as well as contribute to family hardiness. Parents need to be allowed to ask questions and voice their concerns. A nurse who understands the family's issues and concerns is better able to plan for support and education. Provide culturally sensitive education and interventions that focus on increasing the family's commitment to, and control of, asthma management. As the child and parents become confident in their ability to recognize asthma symptoms and cope with asthma and its periodic episodes, the family's ability to cope will improve.

THINKING ABOUT DEVELOPMENT

Ryan Jennings is a 13-year-old with a history of moderate asthma. They have been prescribed a long-term control medication to be taken routinely and a rescue medicine to be used as needed and before exercise. The adolescent is a talented pitcher and would like to participate with the school's baseball team.

How will Ryan's developmental stage affect self-care related to their asthma? What is the most appropriate approach for the nurse to take to educate Ryan about the medications and disease process?

How will the nurse foster compliance in Ryan?

Cystic Fibrosis

Cystic fibrosis is an autosomal recessive disorder that affects 40,000 children and adults in the United States (Cystic Fibrosis Foundation [CFF], n.d.). A deletion occurring on the long arm of chromosome 7 at the cystic fibrosis transmembrane conductance regulator (CFTR) is the responsible gene mutation. DNA testing can be used prenatally and in newborns to identify the presence of the mutation. The American College of Obstetricians and Gynecologists (2021) currently recommends screening for cystic fibrosis to any person seeking preconception or prenatal care. At present, all states include testing for cystic fibrosis as part of newborn screening.

Cystic fibrosis is the most common debilitating disease of childhood among those of European descent. Medical advances in recent years have greatly increased the length and quality of life for affected children, with median age for survival being 39.3 years (Katkin, 2023). Complications include hemoptysis, pneumothorax, bacterial colonization, cor pulmonale, volvulus,

intussusception, intestinal obstruction, rectal prolapse, gastroesophageal reflux disease, diabetes, portal hypertension, liver failure, gallstones, and decreased fertility.

Pathophysiology

In cystic fibrosis, the CFTR mutation causes alterations in epithelial ion transport on mucosal surfaces, resulting in generalized dysfunction of the exocrine glands. The epithelial cells fail to conduct chloride, and water transport abnormalities occur. This results in thickened, tenacious secretions in the sweat glands, gastrointestinal tract, pancreas, respiratory tract, and other exocrine tissues. The increased viscosity of these secretions makes them difficult to clear. The sweat glands produce a larger amount of chloride, leading to a salty taste of the skin and alterations in electrolyte balance and dehydration. The pancreas, intrahepatic bile ducts, intestinal glands, gallbladder, and submaxillary glands become obstructed by viscous mucus and eosinophilic material. Pancreatic enzyme activity is lost, and malabsorption of fats, proteins, and carbohydrates occurs, resulting in poor growth and large, malodorous stools. Excess mucus is produced by the tracheobronchial glands. Abnormally thick mucus plugs the small airways, and then bronchiolitis and further plugging of the airways occur. Secondary bacterial infection with *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Burkholderia cepacia* often occurs. This contributes to obstruction and inflammation, leading to chronic infection, tissue damage, and respiratory failure. Nasal polyps and recurrent sinusitis are common. Tenacious seminal fluid and blocking of the vas deferens often make males with cystic fibrosis infertile. In females, thick cervical secretions might limit penetration of sperm (Katkin, 2023). Table 40.3 gives further details of the pathophysiology and resulting respiratory and gastrointestinal clinical manifestations of cystic fibrosis.

Therapeutic Management

Therapeutic management of cystic fibrosis is aimed toward minimizing pulmonary complications, maximizing lung function, preventing infection, and facilitating growth. All children with cystic fibrosis who

TABLE 40.3 • Pathophysiology of Cystic Fibrosis and Resultant Respiratory and Gastrointestinal Clinical Manifestations

Defect in the CFTR Gene Effects	Pathophysiology	Clinical Manifestations
Respiratory tract	• Infection leads to neutrophilic inflammation. • Cleavage of complement receptors and immunoglobulin G leads to opsonophagocytosis failure. • Chemoattractant interleukin-8 and elastin degradase contribute to inflammatory response. • Thick, tenacious sputum that is chronically colonized with bacteria results. • Air trapping related to airway obstruction occurs. • Pulmonary parenchyma is eventually destroyed.	• Airway obstruction • Difficulty clearing secretions • Respiratory distress and impaired gas exchange • Chronic cough • Barrel-shaped chest • Decreased pulmonary function • Clubbing • Recurrent pneumonia • Hemoptysis • Pneumothorax • Chronic sinusitis • Nasal polyps • Cor pulmonale (right-sided heart failure)
Gastrointestinal tract	• Decreased chloride and water secretion into the intestine (causing dehydration of the intestinal material) and into the bile ducts (causing increased bile viscosity) • Reduced pancreatic bicarbonate secretion • Hypersecretion of gastric acid • Insufficiency of pancreatic enzymes (amylase, lipase, pancrease) necessary for digestion and absorption • Pancreas secretes thick mucus.	• Meconium ileus • Retention of fecal matter in distal intestine, resulting in vomiting, abdominal distention and cramping, anorexia, right lower quadrant pain • Sludging of intestinal contents may lead to fecal impaction, rectal prolapse, bowel obstruction, and intussusception. • Obstructive cirrhosis with esophageal varices, and splenomegaly • Gallstones • Gastroesophageal reflux disease (compounded by postural drainage with chest physiotherapy) • Inadequate protein absorption • Altered absorption of iron and vitamins A, D, E, and K • Failure to thrive • Hyperglycemia and development of diabetes later in life

Data from Houin, P., Stillwell, P., Deboer, E. M., & Hoppe, J. (2022). Respiratory tract & mediastinum. In M. Bunik, W. W. Hay, M. J. Levin, & M. J. Abzug (Eds.), *Current diagnosis and treatment: Pediatrics* (26th ed.). McGraw-Hill Education; Katkin, J. P. (2023). Cystic fibrosis: Clinical manifestations and diagnosis. *UpToDate*. Retrieved March 11, 2024, from https://www.uptodate.com/contents/cystic-fibrosis-clinical-manifestations-and-diagnosis

have pulmonary involvement require CPT with postural drainage (or an alternate method) several times daily to mobilize secretions from the lungs. Physical exercise is encouraged. Recombinant human DNase (Pulmozyme) is given daily using a nebulizer to decrease sputum viscosity and help clear secretions. Inhaled bronchodilators and antiinflammatory agents are prescribed for some children. Aerosolized antibiotics are often prescribed and may be given at home as well as in the hospital. Choice of antibiotic is determined by sputum culture and sensitivity results. Pancreatic enzymes and supplemental fat-soluble vitamins are prescribed to promote adequate digestion and absorption of nutrients and optimize nutritional status. Increased-calorie, high-protein diets are recommended, and sometimes supplemental high-calorie formula, either orally or via feeding tube, is needed. Some children require total parenteral nutrition to maintain or gain weight. Lung transplantation has been successful in some children with cystic fibrosis.

TAKE NOTE!

Children 6 years and older who have particular mutations of the cystic fibrosis gene may be prescribed a CFTR modulator such as ivacaftor or lumacaftor. Use of the CFTR modulator results in thinning of lung mucus, resulting in easier airway clearance via coughing (Simon, 2023).

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to the "Clinical Judgment and the Nursing Process" section earlier in the chapter. Assessment findings pertinent to cystic fibrosis are discussed further on.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history in the undiagnosed child might include:

- A salty taste to the child's skin (resulting from excess chloride loss via perspiration)
- Meconium ileus or late, difficult passage of meconium stool in the newborn period
- Abdominal pain or difficulty passing stool (infants or toddlers might present with intestinal obstruction or intussusception at the time of diagnosis)
- Bulky, greasy stools
- Poor weight gain and growth despite good appetite
- Chronic or recurrent cough and/or upper or lower respiratory infections

Children known to have cystic fibrosis are often admitted to the hospital for pulmonary exacerbations or other complications of the disease. The health history should include questions related to:

- respiratory status: has cough, sputum production, or work of breathing increased?
- appetite and weight gain.
- activity tolerance.
- increased need for pulmonary or pancreatic medications.
- presence of fever.
- presence of bone pain.
- any other changes in physical state or medication regimen.

Physical Examination

The physical examination includes inspection, percussion, palpation, and auscultation.

INSPECTION

Observe the child's general appearance and color. Check the nasal passages for polyps. Note respiratory rate, work of breathing, use of accessory muscles, position of comfort, frequency and severity of cough, and quality and quantity of sputum produced. The child with cystic fibrosis often has a barrel chest (anterior–posterior diameter approximates transverse diameter) (Fig. 40.13). Clubbing of the nail beds might also be present. Note whether rectal prolapse is present. Does the child appear small or thin for their age? The child might have a protuberant abdomen and thin extremities, with decreased amounts of subcutaneous fat. Observe for the

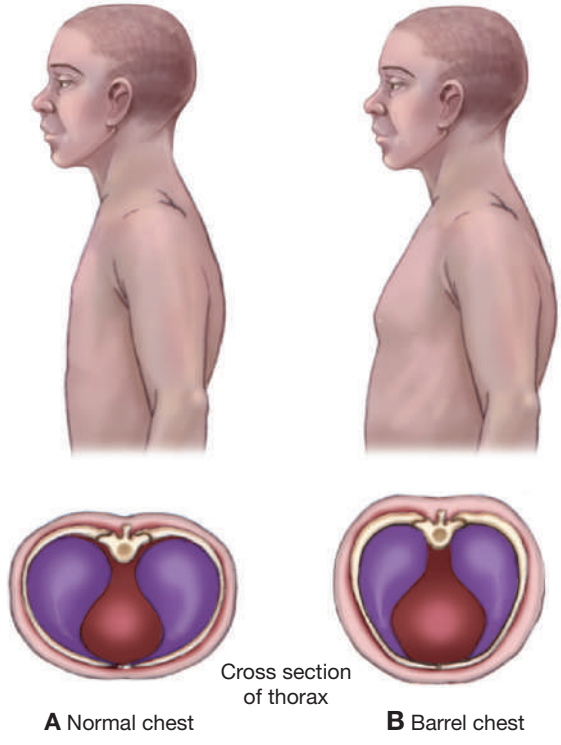


FIGURE 40.13 **A.** Normal chest shape—transverse diameter is greater than anterior–posterior diameter. **B.** Barrel chest—transverse diameter equals anterior–posterior diameter.

presence of edema (sign of cardiac or liver failure). Note distended neck veins or the presence of a heave (signs of cor pulmonale).

PERCUSSION AND PALPATION

Percussion over the lung fields usually yields hyperresonance due to air trapping. Diaphragmatic excursion might be decreased. Percussion of the abdomen might reveal dullness over an enlarged liver or mass related to intestinal obstruction. Palpation might yield a finding of asymmetric chest excursion if atelectasis is present. Tactile fremitus may be decreased over areas of atelectasis. Note if tenderness is present over the liver (might be an early sign of cor pulmonale).

AUSCULTATION

Auscultation may reveal a variety of adventitious breath sounds. Fine or coarse crackles and scattered or localized wheezing might be present. With progressive obstructive pulmonary involvement, breath sounds might be diminished. Tachycardia might be present. Note the presence of a gallop (might occur with cor pulmonale). Note the adequacy of bowel sounds.

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the diagnosis and assessment of cystic fibrosis include:

- Sweat chloride test: considered suspicious if the level of chloride in collected sweat is above 50 mEq/L and diagnostic if the level is above 60 mEq/L.
- Pulse oximetry: oxygen saturation might be decreased, particularly during a pulmonary exacerbation.
- Chest radiograph: may reveal hyperinflation, bronchial wall thickening, atelectasis, or infiltration.
- PFTs: might reveal a decrease in forced vital capacity and forced expiratory volume, with increases in residual volume.

Nursing Management

Management of cystic fibrosis focuses on minimizing pulmonary complications, promoting growth and development, and facilitating coping and adjustment by the child and family. In addition to the patient problems and related interventions discussed in the "Clinical Judgment and the Nursing Process" section earlier in the chapter, interventions common to cystic fibrosis follow.

Maintaining Patent Airway

Provide CPT, use of the vest airway clearance system, use of the flutter-valve device, and/or positive expiratory pressure therapy to clear secretions and maintain airway patency. For children with cystic fibrosis, CPT is a critical intervention. CPT involves percussion, vibration, and postural drainage, and either it or another bronchial hygiene therapy must be performed several times a day to assist with mobilization of secretions. Nursing Procedure 40.2 gives instructions on the CPT technique. The vest airway clearance system provides high-frequency chest wall oscillation to increase airflow velocity to create repetitive cough-like shear forces and to decrease the viscosity of secretions (Hill-Rom, 2021).

For older children and adolescents, the flutter-valve device provides high-frequency oscillation to the airway as the child exhales into a mouthpiece that contains a steel ball. Positive expiratory pressure therapy involves exhaling through a flow resistor, which creates positive

NURSING PROCEDURE 40.2 Performing Chest Physiotherapy

May be preceded by an inhalation treatment; should not be performed after eating.

1. Provide percussion via a cupped hand or an infant percussion device. Appropriate percussion yields a hollow sound, not a slapping sound.

(*continued*)

NURSING PROCEDURE 40.2 Performing Chest Physiotherapy (*continued*)

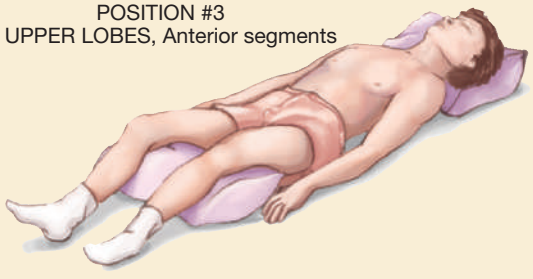
2. Percuss each segment of the lung for 1 to 2 minutes.

POSITION #1, for infants
UPPER LOBES, Apical segments

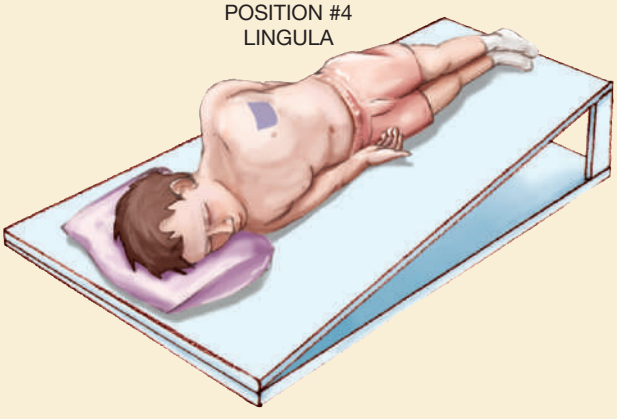
POSITION #1
UPPER LOBES, Apical segments

POSITION #2
UPPER LOBES, Posterior segments

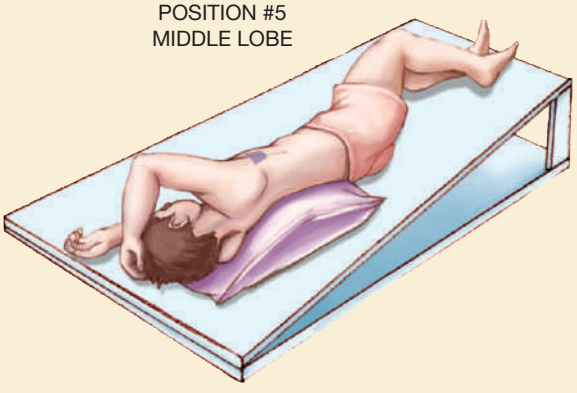
POSITION #3
UPPER LOBES, Anterior segments



POSITION #4
LINGULA

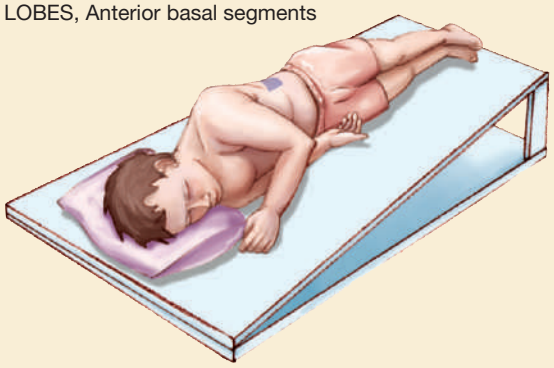


POSITION #5
MIDDLE LOBE



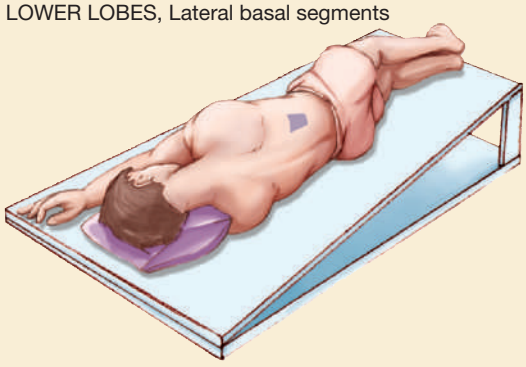
NURSING PROCEDURE 40.2 Performing Chest Physiotherapy

POSITION #6
LOWER LOBES, Anterior basal segments

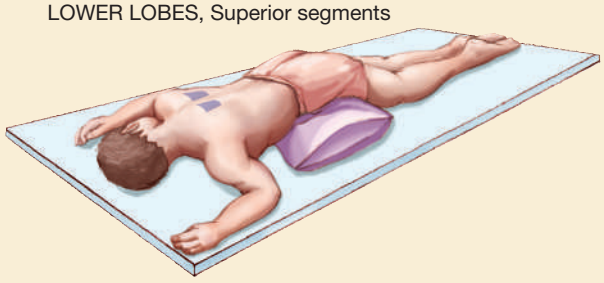


POSITION #7
LOWER LOBES, Posterior basal segments

POSITION #8 & 9
LOWER LOBES, Lateral basal segments



POSITION #10
LOWER LOBES, Superior segments



3. Place the ball of the hand on the lung segment, keeping the arm and shoulder straight. Vibrate by tensing and relaxing your arms during the child's exhalation. Vibrate each lung segment for at least five exhalations.
4. Encourage the child to deep breathe and cough.
5. Change drainage positions, and repeat percussion and vibration.

expiratory pressure. The cycles of exhalation are repeated until coughing yields expectoration of secretions. Breathing exercises are also helpful in promoting mucus clearance. Encourage physical exercise, as it helps to promote mucus secretion as well as providing cardiopulmonary conditioning. Ensure that Pulmozyme is administered, as well as inhaled bronchodilators and antiinflammatory agents, if prescribed.

Preventing Infection

Ensure parents and older children understand that vigorous pulmonary hygiene to mobilize secretions is critical to preventing infection. Administer aerosolized antibiotics as prescribed either in the hospital or teach parents to provide them at home. Children with frequent or severe respiratory exacerbations might require lengthy courses of intravenous antibiotics.

Maintaining Growth

Administer pancreatic enzyme supplements (pancrelipase [Creon, Pancreaze, Zenpep]) with all meals and snacks to promote adequate digestion and absorption of nutrients. The number of capsules required depends on the extent of pancreatic insufficiency and the amount of food being ingested. The dosage can be adjusted until an adequate growth pattern is established and the number of stools is consistent at one or two per day. Children will need additional enzyme capsules when high-fat foods are being eaten. In the infant or young child, the enzyme capsule can be opened and sprinkled on cereal or applesauce. Provide a well-balanced, high-calorie, high-protein diet to ensure adequate growth. Some children require up to one and a half times the recommended daily allowance of calories for children their age. A number of commercially available nutritional formulas and shakes are available for diet supplementation.

In infants, breastfeeding should be continued with enzyme administration. Some infants will require fortification of breast milk or supplementation with high-calorie formulas. Commercially available infant formulas can continue to be used for the formula-fed infant and can be mixed to provide a larger number of calories if necessary. Administer vitamins A, D, E, and K supplementally. Administer gavage feedings or total parenteral nutrition as prescribed to provide for adequate growth.

Promoting Family Coping

Assist families to learn to cope with the daily interventions required for the serious chronic illness of cystic fibrosis. Help families develop a schedule for provision of pulmonary hygiene several times daily as well as close attention to appropriate diet and enzyme supplementation. Adjusting to the demands that the illness places on the child and family is difficult. Continual adjustments within the family must occur. Children are frequently hospitalized, and this may place an additional strain on the family and its finances. Children with cystic fibrosis may express fear or feelings of isolation, and siblings may be worried or jealous. Encourage the family to lead a normal life through involvement in activities and school attendance during periods of wellness.

Starting at the time of diagnosis, families often demonstrate significant stress as the severity of the diagnosis and the significance of disease chronicity become real for them. Involve the family in the child's care from the time of diagnosis, whether in the outpatient setting or in the hospital. Ongoing education about the illness and its treatments is necessary. Once the initial shock of diagnosis has passed and the family has adjusted to initial care, the family usually learns how to manage the requirements of care. Powerlessness gives way to adaptation. As family members become more comfortable with their understanding of the illness and the required treatments, they will eventually become the experts on the child's care. It is important for the nurse to recognize and respect the family's changing needs over time.

Providing daily intense care can be tiring, and noncompliance on the part of the family or child might occur because of this fatigue. Hypervigilance may also occur as parents attempt to control the difficult situation and protect the child. Families welcome support and encouragement. Most families eventually progress past the stages of fear, guilt, and powerlessness to a way of living that is different than what they anticipated but is something that they can manage.

Refer parents to a local support group for families of children with cystic fibrosis. The CFF has chapters throughout the United States. Parents of children with a terminal illness might face the death of their child at an earlier age than expected. Assisting with anticipatory grieving and making decisions related to end-of-life care are other important nursing interventions.

Preparing the Child and Family for Adulthood with Cystic Fibrosis

With current technologic and medication advances and the use of lung transplantation, children with cystic fibrosis are living well into adulthood. Children with cystic fibrosis should have the goal of independent living as adults, as other children do. Making the transition from a pediatric medical home to an adult medical home should be viewed as a normal part of growing up, like completing school or finding a first job. Pediatric clinics are focused on family-centered care that heavily involves the child's parents, but adults with cystic fibrosis need a different focus, one that views them as independent adults.

Those with cystic fibrosis can make the transition from pediatric to adult care with thoughtful preparation and coordination. They desire and deserve a smooth transition in care that will result in appropriate ongoing medical management of cystic fibrosis in an environment that is geared toward adults rather than children.

Adults with cystic fibrosis can find rewarding work and pursue relationships. Most males with cystic fibrosis are capable of sexual intercourse, although unable to reproduce. Females might have difficulty conceiving, and when they do, they should be cautioned about the additional respiratory strain that pregnancy causes. All children of parents with cystic fibrosis will be carriers of the gene.

Apnea

Apnea is defined as absence of breathing for longer than 20 seconds; it might be accompanied by bradycardia. Sometimes, apnea presents in the form of a brief, resolved, unexplained event (BRUE) in which the infant or child exhibits some combination of apnea, color change, muscle tone alteration, coughing, or gagging. Apnea may also occur acutely at any age because of respiratory distress. This discussion will focus on apnea that is chronic or recurrent in nature or that occurs as part of a BRUE.

Apnea in infants may be central (unrelated to any other cause) or may occur with other illnesses such as sepsis and respiratory infection. Apnea in newborns might be associated with hypothermia, hypoglycemia, infection, or hyperbilirubinemia. Apnea of prematurity occurs secondary to an immature respiratory system. Apnea should not be considered a predecessor to sudden unexplained infant death (SUID). Current research has not proven this theory, and SUID generally occurs in otherwise healthy young infants (Moon et al., 2022). Box 40.4 gives more information about SUID and its prevention.

Therapeutic management of apnea varies depending on the cause. When apnea occurs as a result of another disorder or infection, treatment is directed toward that cause. In the event of apnea, stimulation may trigger

BOX 40.4 Sudden Unexplained Infant Death (SUID)

Definition

Sudden death of a previously healthy infant younger than 1 year of age

Prevention

- Place all infants in the supine position to sleep.
- Provide a firm sleep surface and avoid soft bedding, bumper pads, excess covers, pillows, and stuffed animals in the crib.
- Avoid maternal prenatal smoking and exposure of the infant to secondhand smoke.
- Avoid maternal prenatal alcohol and illicit drug exposure.
- Ensure the infant sleeps in a separate bed from the parents, in the parents' room, for the first 6 months of life.
- Avoid overdressing the infant and using head coverings.
- Encourage pacifier use during naps and at bedtime if the infant is receptive to it (AAP, 2024).

Support and Information

- American SIDS Institute: www.sids.org
- National SUID/SIDS Resource Center: www.sidscenter.org
- SIDS Network, Inc.: http://sids-network.org/

the infant to take a breath. If breathing does not resume, rescue breathing, or bag-valve-mask ventilation is necessary. Infants and children who have experienced a BRUE or who have chronic apnea may require ongoing cardiac/apnea monitoring. Caffeine citrate is sometimes administered, primarily in premature infants, to stimulate respirations (S. Smith, 2022).

Nursing Assessment

Question the parents about the infant's position and activities preceding the apneic episode. Did the infant experience a color change? Did the infant self-stimulate (breathe again on their own), or did they require stimulation from the caregiver? Assess risk factors for apnea, which may include prematurity, anemia, and history of metabolic disorders. Apnea may occur in association with cardiac or neurologic disturbances, respiratory infection, sepsis, child abuse, or poisoning.

In the hospitalized infant, note absence of respiration, position, color, and other associated findings, such as emesis on the bedclothes. If an infant who is apneic fails to be stimulated and does not breathe again, pulselessness will result.

Nursing Management

When an infant is noted to be apneic, gently stimulate them to take a breath again. If gentle stimulation is unsuccessful, then rescue breathing or bag-valve-mask ventilation must be started. To avoid apnea in the newborn, maintain a neutral thermal environment. Administer caffeine or theophylline if prescribed, and teach families about the use of these medications.

FIGURE 40.14 The home apnea monitor uses a soft belt with a Velcro attachment to hold two leads in the appropriate position on the chest.

Infants with recurrent apnea or BRUE may be discharged on a home apnea monitor (Fig. 40.14). Provide education on use of the monitor, guidance about when to notify the primary provider or nurse practitioner or monitor service about alarms, and training in infant CPR. The monitor is usually discontinued after 3 months without a significant event of apnea or bradycardia. In some ways, the monitor gives parents peace of mind, but in others it can make them more nervous about the well-being of their child. When apnea monitors are used in the home, parental sleep may be disrupted by machine alarms. Parents often express increased fear, anxiety, and depressive symptoms associated with home monitoring (Corwin, 2023). Providing appropriate education to the parents about the nature of the child's disorder as well as action to take in the event of apnea may give the family a sense of mastery over the situation, thus decreasing their anxiety. Refer families to local support groups such as those offered by Parent to Parent and Parents Helping Parents.

TRACHEOSTOMY

A tracheostomy is an artificial opening in the airway; usually, a plastic tracheostomy tube is in place to form a patent airway. Tracheostomies are performed to relieve airway obstruction, such as with subglottic stenosis (narrowing of the airway sometimes resulting from long-term intubation). They are also used for pulmonary hygiene and in the child who requires chronic mechanical ventilation. The tracheostomy facilitates secretion removal, reduces work of breathing, and increases the child's comfort. In some cases, the tracheostomy facilitates mechanical ventilation weaning. It may be permanent or temporary, depending on the indication. The tracheostomy tube varies in size and type depending on the child's airway size and health and the length of time the child will require the tracheostomy. Silastic tracheostomy tubes are soft

and flexible; they are available with a single lumen or may have an outer and inner lumen. Both types have an obturator (the guide used during tube changes). Uncuffed tubes are used more often in the pediatric population. Figure 40.15 shows various types of tracheostomy tubes.

Complications immediately after surgery include hemorrhage, air entry, pulmonary edema, anatomic damage, and respiratory arrest. At any point in time, the tracheostomy tube may become occluded, which compromises ventilation. Complications of chronic tracheostomy include infection, cellulitis, and formation of granulation tissue around the insertion site.

Nursing Assessment

When obtaining the history for a child with a tracheostomy, note the reason for the tracheostomy, as well as the size and type of tracheostomy tube. Inspect the site. The stoma should appear pink and without bleeding or drainage. The tube itself should be clean and free from secretions. The tracheostomy ties should fit securely, allowing one finger to slide beneath the ties. Inspect the skin under the ties for rash or redness. Observe work of breathing.

When caring for the infant or child with a tracheostomy, whether in the hospital, home, or community setting, a thorough respiratory assessment is necessary. Note the presence of secretions and their color, thickness, and amount. Auscultate for breath sounds, which should be clear and equal throughout all lung fields. Measure pulse oximetry. When infection is suspected or secretions are discolored or have a foul odor, a sputum culture may be obtained.

TAKE NOTE!

Keep small toys (risk of aspiration), plastic bibs or bedding (risk of airway occlusion), and talcum powder (risk of inhalation injury) out of reach of the child with a tracheostomy.

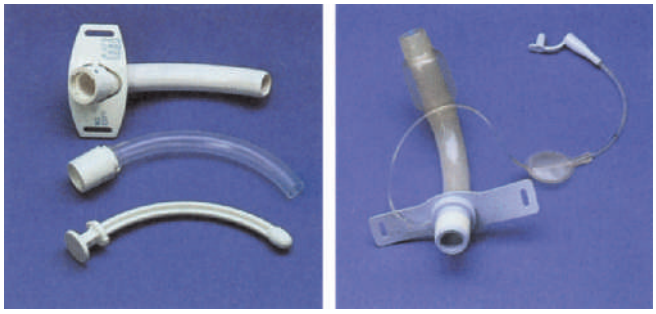


FIGURE 40.15 Note smaller size and absence of inner cannula on particular brands of pediatric tracheostomy tubes.

Nursing Management

In the immediate postoperative period, the infant or child may require restraints to avoid accidental dislodgment of the tracheostomy tube. Infants and children who have had a tracheostomy for a period of time become accustomed to it and usually do not attempt to remove the tube. Since air inspired via the tracheostomy tube bypasses the upper airway, it lacks humidification, and this lack of humidity can lead to a mucous plug in the tracheostomy and resultant hypoxia. Provide humidity to either room air or oxygen via a tracheostomy collar or ventilator, depending on the child's need (Fig. 40.16). Box 40.5 lists the equipment that should be available at the bedside of any child who has a tracheostomy.

Tracheostomies require frequent suctioning to maintain patency. The appropriate length for insertion of the suction catheter depends on the size of the tracheostomy and the child's needs. Place a sign at the head of the child's bed indicating the suction catheter size and the length (in centimeters) that it should be inserted for suctioning. Keep an extra tracheostomy tube of the same size and one size smaller at the bedside in the event of an emergency.

Many pediatric tracheostomy tubes do not have an inner cannula that requires periodic removal and cleaning, so periodic removal and replacement of the chronic tracheostomy tube is required. Clean the removed tracheostomy tube with half-strength hydrogen peroxide and pipe cleaners. Rinse with distilled water and allow it to dry. The tracheostomy tube can be reused many times if adequately cleaned between uses.

Perform tracheostomy care every 8 hours or per institution protocol. Change the tracheostomy tube only as needed or per institution protocol. Nursing Procedure 40.3 gives information about tracheostomy care. Always change tracheostomy ties with an assistant to avoid accidental dislodgement of the tube.

FIGURE 40.16 The trach collar allows for humidification of inspired air or supplemental oxygen.

BOX 40.5 Emergency Equipment (Available at Bedside)

- Two spare tracheostomy tubes (one the same size and one a size smaller)
- Suction equipment
- Stitch cutter (new tracheostomy)
- Spare tracheostomy ties
- Lubricating jelly
- Bag-valve-mask device
- Call bell within child's/parent's reach

If the older child or teen has a tracheostomy tube with an inner cannula, care of the inner cannula is similar to that of an adult. Involve parents in care of the tracheostomy and begin education about caring for the tracheostomy tube at home as soon as the child is stable. The child with a tracheostomy often qualifies for a Medicaid waiver that will provide a certain amount of home nursing care. Refer the family to local support groups.

NURSING PROCEDURE 40.1 Tracheostomy Care

1. Gather the necessary equipment:
   - Cleaning solution
   - Gloves
   - Precut gauze pad
   - Cotton-tipped applicators
   - Clean tracheostomy ties
   - Extra tracheostomy tube in case of accidental dislodgement
2. Position the infant/child supine with a blanket or towel roll to extend the neck.
3. Open all packaging and cut tracheostomy ties to appropriate length if necessary.
4. Cleanse around the tracheostomy site with prescribed solution (half-strength hydrogen peroxide or acetic acid, normal saline or soap and water if at home) and cotton-tipped applicators, working from just around the tracheostomy tube outward.
5. Rinse with sterile water and cotton-tipped applicator in similar fashion.
6. Place the precut sterile gauze under the tracheostomy tube.
7. With the assistant holding the tube in place, cut the ties and remove from the tube.
8. Attach the clean ties to the tube, and tie or secure in place with Velcro (Fig. 40.17).

FIGURE 40.17 Trach ties are attached to the tube and secured in place with Velcro.

Unfolding Patient Stories: Sabina Vasquez • Part 2

Recall Sabina Vasquez from Chapter 27, a 5-year-old diagnosed with asthma who uses an albuterol inhaler. What questions and assessments help the nurse evaluate her current respiratory status during a routine clinic visit? What methods can the nurse use to guide asthma management and determine how well Sabina's asthma is managed at home?

Care for Sabina and other patients in a realistic virtual environment: ***vSim*** *for Nursing* (thepoint.lww.com/vSimPediatric). Practice documenting these patients' care in DocuCare (thePoint.lww.com/DocuCareEHR).

KEY CONCEPTS

- Respiratory infections account for the majority of acute illnesses in children.
- The upper and lower airways are smaller in children than in adults, making them more susceptible to obstruction in the presence of mucus, debris, or edema.
- Newborns are preferential nose breathers.
- The child's highly compliant airway is quite susceptible to dynamic collapse in the presence of airway obstruction.
- Because they have fewer alveoli, children have a higher risk of hypoxemia than adults.
- Generally, disorders of the nose and throat do not result in increased work of breathing or affect the

lungs. Thus, if the lungs are involved, lower respiratory disease must be considered.
- Wheezing may be associated with a variety of lower respiratory disorders, such as asthma, bronchiolitis, and cystic fibrosis.
- Pulse oximetry is a useful tool for determining the extent of hypoxia. Findings should be correlated with the child's clinical presentation.
- Rapid streptococcus and rapid influenza tests are very useful for the quick diagnosis of strep throat or influenza so that appropriate treatment may be instituted early in the illness.
- Supplemental oxygen is often necessary in the child who is hospitalized (particularly with lower respiratory disease). Oxygen should be humidified to prevent drying of secretions.
- Suctioning, whether with a bulb syringe or suction catheter, is very effective at maintaining airway patency, especially in the younger child or infant.
- Normal saline nasal wash is an inexpensive, simple, and safe method for decongesting the nose in the case of the common cold, allergic rhinitis, and sinusitis.
- Infants who were born prematurely; children with a chronic illness such as diabetes, congenital heart disease, sickle cell anemia, or cystic fibrosis; and children with developmental disorders such as cerebral palsy tend to be more severely affected with respiratory disorders.
- Passive cigarette smoke exposure increases the infant's and child's risk of respiratory disease.
- Continual swallowing while awake or asleep is an indication of bleeding in the postoperative tonsillectomy child.
- Positioning to ease work of breathing and maintaining a patent airway are priorities for the child with a respiratory disorder.
- To avoid Reye syndrome, aspirin should not be given to treat fever or pain in the infant or child with a viral infection.
- Infants younger than 8 months of age whose birth parent did not receive the RSV vaccine during pregnancy should receive one dose of nirsevimab just prior to or at the onset of the RSV season.
- Children older than 6 months of age should be immunized against influenza yearly.
- Children at high risk for exposure to TB should be screened for infection.
- Promoting airway clearance and maintenance, effective breathing patterns, and adequate gas exchange is the priority focus of nursing intervention in pediatric respiratory disease.
- Children with any degree of respiratory distress require frequent assessment and early intervention to prevent progression to respiratory failure.
- Avoidance of allergens is critical in the treatment plan for the child with allergic rhinitis.
- Avoidance of allergic triggers, control of the inflammatory process, and education of the child and family are the focus of asthma management.
- CPT is extremely useful for mobilizing secretions in any condition resulting in an increase in mucus production and is required in children with cystic fibrosis.
- Children with chronic respiratory disorders and their families often need large amounts of education and psychosocial support: children often experience fear and isolation, while families must learn to balance care of the chronically ill child with other family life.

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DEVELOPING CLINICAL JUDGMENT

PRACTICING FOR NCLEX

1. A 5-month-old infant with RSV bronchiolitis is in respiratory distress. The infant has copious secretions, increased work of breathing, cyanosis, and a respiratory rate of 78. What is the most appropriate initial nursing intervention?
   - **a.** Attempt to calm the infant by placing them in the parent's lap and offering them a bottle.
   - **b.** Alert the primary provider or nurse practitioner to the situation, and ask for an order for a stat chest radiograph.
   - **c.** Suction secretions, provide 100% oxygen via mask, and anticipate respiratory failure.
   - **d.** Bring the emergency equipment to the room and begin bag-valve-mask ventilation.

2. A toddler has moderate respiratory distress, is mildly cyanotic, and has increased work of breathing, with a respiratory rate of 40. What is the priority nursing intervention?
   - **a.** Airway maintenance and 100% oxygen by mask
   - **b.** 100% oxygen and pulse oximetry monitoring
   - **c.** Airway maintenance and continued reassessment
   - **d.** 100% oxygen and provision of comfort

3. The nurse is caring for a child with cystic fibrosis who receives pancreatic enzymes. Which statement by the child's parent indicates an understanding of how to administer the supplemental enzymes?
   - **a.** "I will stop the enzymes if my child is receiving antibiotics."
   - **b.** "I will decrease the dose by half if my child is having frequent, bulky stools."
   - **c.** "Between meals is the best time for me to give the enzymes."
   - **d.** "The enzymes should be given at the beginning of each meal and snack."

4. Which of these factors contributes to infants' and children's increased risk for upper airway obstruction as compared with adults?
   - **a.** Underdeveloped cricoid cartilage and narrow nasal passages
   - **b.** Small tonsils and narrow nasal passages
   - **c.** Cylinder-shaped larynx and underdeveloped sinuses
   - **d.** Underdeveloped cricoid cartilage and smaller tongue

5. The school nurse is presented with a child whose nose began bleeding a few moments ago. Which is the appropriate nursing intervention?
   - **a.** Have the child lie down and breathe through the mouth; then apply pressure to the bridge of the nose.
   - **b.** Have the child lie down and breathe through the mouth; then pinch the lower third of the nose closed.
   - **c.** Instruct the child to sit up and lean forward; then apply pressure to the bridge of the nose.
   - **d.** Instruct the child to sit up and lean forward; then pinch the lower third of the nose closed.

6. The nurse is caring for a toddler who was admitted for observation because of respiratory changes. The parent states the child doesn't want to eat and seems tired.

NURSE'S NOTES

Time	Notes
1200	Alert, fearful of RN, resists examination. Color pink. Skin warm, dry, intact. Heart rate regular without murmur. Minimal intercostal retractions. Harsh cough.
1400	Parent called RN to room as toddler is restless. Does not resist examination. Color pink. Skin warm, diaphoretic. Heart rate regular with murmur. Moderate intercostal retractions, with mild nasal flaring. Harsh cough.

VITAL SIGNS

Time	Temperature	Pulse	Respiratory Rate	Blood Pressure
1200	37.4°C (99.4°F)	100 (beats per minute)	28 (breaths per minute)	118/70
1400	37.2°C (99.0°F)	110 (beats per minute)	34 (breaths per minute)	Not taken

Which assessment findings indicate the toddler is progressing to respiratory distress? Select all that apply.

- **a.** Cough
- **b.** Diaphoresis
- **c.** Heart rate
- **d.** Malaise
- **e.** Nasal flaring
- **f.** Respiratory rate
- **g.** Restlessness
- **h.** Retractions

1. A young infant has been diagnosed with bronchiolitis in the clinic. The infant will be cared for at home. What should the nurse include when teaching the parent about home care? Select all that apply.
   - **a.** Offer small amounts of fluids frequently.
   - **b.** Use the nebulizer machine as instructed.
   - **c.** Allow the infant to sleep prone for comfort.
   - **d.** Call the clinic if the infant vomits.
   - **e.** Perform chest physiotherapy every 4 hours.
   - **f.** Watch for difficulty breathing.

DOSAGE CALCULATION QUESTION

1. The nurse is caring for a child with acute asthma. The child weighs 37½ lb. The medication order reads: methylprednisolone 20 mg IV twice a day. The Pediatric Dosage Handbook provides a recommended dose for acute asthma of 1 to 2 mg/kg/day in two divided doses. Is the ordered dose safe?

CRITICAL THINKING EXERCISES

1. A 10-month-old infant is admitted to the pediatric unit with a history of recurrent pneumonia and failure to thrive. The sweat chloride test confirms the diagnosis of cystic fibrosis. The infant is frail in appearance with thin extremities and a slightly protuberant abdomen. The infant is tachypneic, has retractions, and coughs frequently. Based on the limited information given here and your knowledge of cystic fibrosis, choose three of the following categories as priorities to focus on when planning the infant's care:
   - **a.** Prevention of bronchospasm
   - **b.** Promotion of adequate nutrition
   - **c.** Education of the child and family
   - **d.** Prevention of pulmonary infection
   - **e.** Balancing fluid and electrolytes
   - **f.** Management of excess weight gain
   - **g.** Prevention of spread of infection
   - **h.** Promoting adequate sleep and rest
2. A child with asthma is admitted to the pediatric unit for the fourth time this year. The parent expresses frustration that the child is getting sick so often. Besides information about onset of symptoms and events leading up to this present episode, what other types of information would you ask for while obtaining the history?
3. The parent of the child in the previous question tells you that they smoke (but never around the child), the family has a cat that comes inside sometimes, and they always give the child the medication prescribed. The parent gives salmeterol and budesonide as soon as they start to cough. When the child is not having an episode, the parent gives them albuterol before baseball games. Diphenhydramine helps the runny nose in the springtime. Based on this new information, what advice/instructions would you give the parent?
4. A 7-year-old presents with a history of recurrent nasal discharge. The child sneezes every time they visit their cousins, who have pets. The child lives in an older home that is carpeted. Tobacco smokers live in the home. The parent reports that the child snores and is a mouth breather. They say the child has symptoms nearly year-round but that they are worse in the fall and the spring. The parent reports that diphenhydramine is somewhat helpful with the symptoms, but they do not like to give it to them on school days because it makes them drowsy. Based on the foregoing history, develop a teaching plan for this child.
5. The nurse is caring for a 4-year-old child who returned from the recovery room after a tonsillectomy 3 hours ago. The child has cried off and on over the past 2 hours and is now sleeping. What areas should the nurse assess and focus on for this child?

STUDY ACTIVITIES

1. While caring for children in the pediatric setting, compare the signs and symptoms of a child with asthma to those of an infant with bronchiolitis. What are the most notable differences? How does the history of the two children differ?
2. A child with asthma has been prescribed Advair (fluticasone and salmeterol), albuterol, and prednisone. Develop a sample teaching plan for the child and family. Include appropriate use of the devices used to deliver the medications, as well as important information about the medications (uses and adverse effects).
3. While caring for children in the pediatric setting, compare the signs and symptoms and presentation of a child with the common cold to those of a child with either sinusitis or allergic rhinitis.
4. While caring for children in the pediatric setting, review the census of children and identify those at risk for severe influenza and thus those who would benefit from annual influenza vaccination.
5. Compare the differences in oxygen administration between a young infant and an older child.