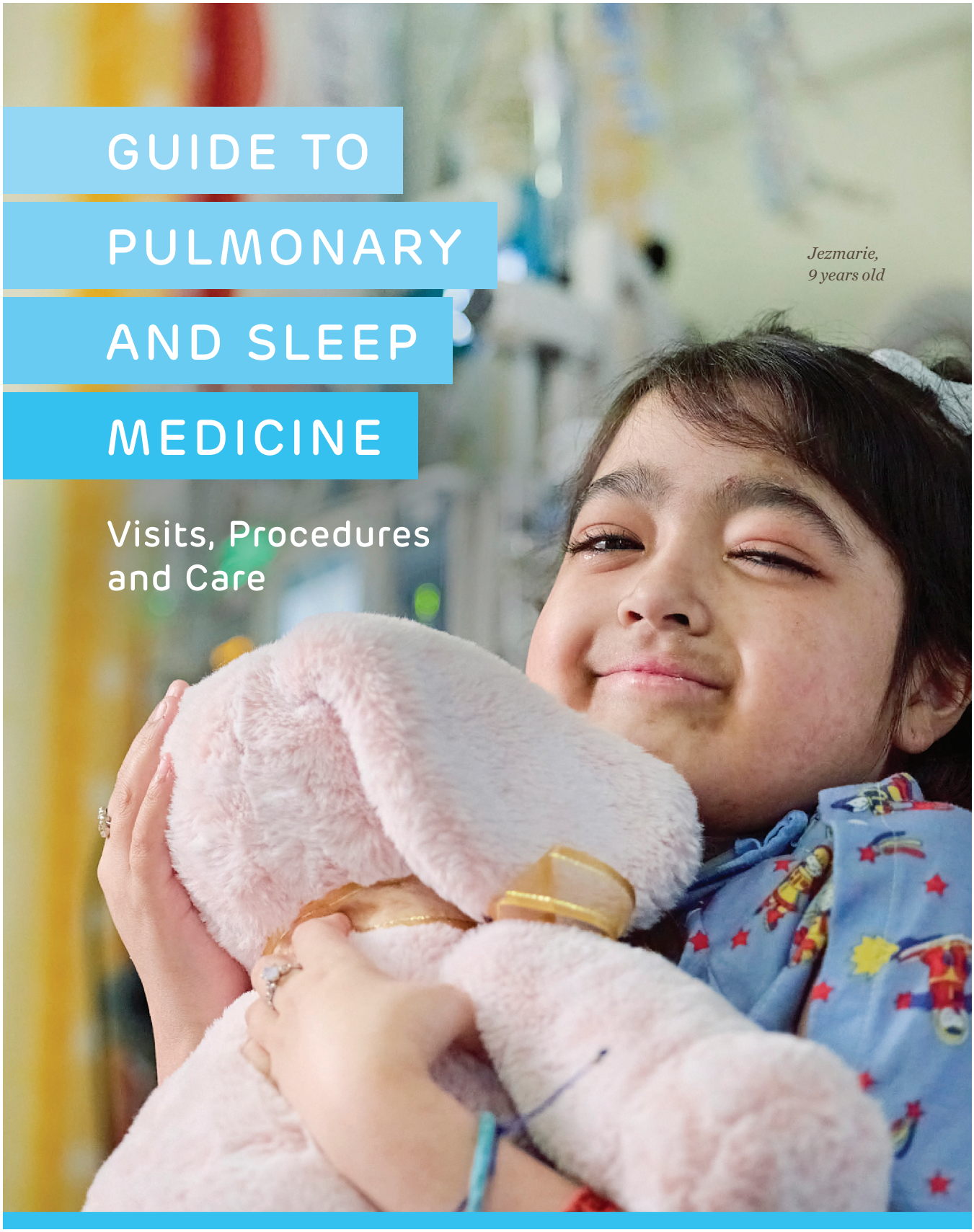
GUIDE TO PULMONARY AND SLEEP MEDICINE

Visits, Procedures and Care



Jezmarie,
9 years old

Children's Hospital of Philadelphia®
Division of Pulmonary & Sleep Medicine

Welcome to Pediatric Pulmonary and Sleep Medicine Clinic at Children's Hospital of Philadelphia. Working with you as our partner, our multidisciplinary team strives to maximize your child's pulmonary health.

Elijah,
6 years old

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EVALUATION

As part of your child's evaluation, they may need to have some tests to help us understand their respiratory symptoms and overall health. Here are some of the tests that may be ordered:

Pulse Oximetry (pulse ox)

- Pulse oximetry measures oxygen levels in the blood.
- The device is placed on a finger or earlobe and uses light to measure how much oxygen is in the blood. If your child is on oxygen, this information can help the healthcare provider to decide how much oxygen they need.
- Extended pulse oximetry is used to determine changes in oxygen levels at rest or with activities.

End Tidal CO2 Measurement

- End Tidal CO2 measures the amount of carbon dioxide your child exhales at the end of a breath. This tells us whether the patient's breaths are too big or small.
- This helps us to decide how much respiratory support they need. End Tidal C02 measurements are most often used for patients with a tracheostomy.

6-minute Walk Test

- We want to see the distance that your child can walk in 6 minutes.
- Your child will walk in a defined space, such as a hallway or large room. While they are walking, we will monitor their breathing, heart rate and pulse ox.

Respiratory Cultures

If your child is not feeling well, we may test sputum or mucus from their airways to look for bacteria or viruses that can cause respiratory symptoms. If possible, they will be asked to cough up mucus, or we may use a cotton swab in their nose or throat to collect a sample for testing. Based on results, we may prescribe antibiotics.

Bronchoscopy

Sometimes we use a bronchoscopy (camera with light and suction) to view the lower airways and collect a sample of lung fluid for testing. Please ask you healthcare provider for additional details regarding this test.

Upper and Lower Airway Imaging

These tests provide detailed pictures of the lungs to help us understand your child's symptoms.

- **Chest X-ray**

  A chest X-ray gives us pictures that show the inside of your child's chest. We may take the pictures from the front and side of the chest.

- **Chest CT**

  A CT gives us more detailed pictures than an X-ray. Sometimes children will be given medicine (sedation) to help them relax and stay still for this test.

- **Video Fluoroscopic Swallow Study**

  This is a type of X-ray that will show us whether your child is able to safely swallow. Your child will be given a variety of food or fluids through a cup or bottle. The radiologist will perform a video recording of your child's swallowing to assess the safety of consuming different food/liquid textures.

- **Magnetic Resonance Imaging (MRI)**

  Healthcare providers may order MRIs to look for blood vessel abnormalities that may affect the heart and lung. MRIs are not used to examine lung tissue at this time. An MRI takes longer than an X-ray. Some children need medicine (sedation) to keep them calm and still during the test.

If your child has had any of these tests outside of CHOP, we may ask you to have the results sent to us. Please ask your healthcare provider for the appropriate link to upload these studies.

Xander and Katorian, 3

Pulmonary Function Tests (PFTs)

PFTs measure your child's lung function and how it compares to other healthy children. Generally, children under 5 years of age cannot perform PFTs since they need to fully cooperate and follow directions during the procedures. PFTs can help your healthcare provider to make decisions about medicines for your child and status of your child's lung health. Here are different types of PFTs your child may take:

Spirometry

- This test is done to look at air flow in the lungs. It measures how much air your child can blow out in one breath.
- For this test your child will have a clip on their nose and a mouthpiece to blow into. We will ask your child to blow out — as if they are blowing out a candle — for at least 3 to 7 seconds. This test will be repeated at least three times during each testing session. We will record the best result.
- Sometimes we may give your child medicine and repeat the test to see if lung function improves.

Lung Volume Measurement

- This test requires cooperation so younger children may not be able to do it.
- Your child will be asked to sit in a small, enclosed space. They will need to wear a nose clip and use a mouthpiece. We will ask them to breathe in different ways.

Maximum Inspiratory Pressures and Maximum Expiratory Pressures

- These studies tell us about the strength of your child's respiratory muscles.
- They are usually done for children who may have muscle weakness that may affect their breathing and ability to cough.
- Your child will have a mouthpiece and a nose clip. They will be asked to take one forceful breath in and blow a forceful breath out.

Fractional Exhaled Nitric Oxide Test (FeNO)

- FeNO measures the amount of nitric oxide exhaled from the lungs.
- This tells us how well your child's asthma treatment is working.
- Your child will have a mouthpiece and nose clips during this test. They will be asked to blow out for about 7 seconds.

Diffusing Capacity of Lung for Carbon Monoxide (DLCO)

- DLCO measures gas exchange in the lungs.
- This test can sometimes detect lung disease caused by fibrosis or scar tissue.
- Your child will wear either a mask or a mouthpiece and nose clips during the test.

Methacholine Challenge

- The Methacholine Challenge shows us how reactive or responsive your child's lungs are. It can tell us whether your child may have asthma.
- We will give your child small doses of methacholine through a nebulizer.
- Some children need extra oxygen while flying in an airplane.
- If your child has a pulse ox reading of 92%-95% while at rest on room air, we may use this test to see if they need oxygen when flying.
- During this test we will expose your child to the oxygen concentration that is similar to that of an airplane cabin. If your child's pulse ox drops below 90% during this test, then your child probably needs extra oxygen when flying.

TESTING PERFORMED BY OTHER SPECIALISTS

Additional tests that may be recommended by your Pulmonary provider:

Exercise Testing

This is used to help us understand if your child is having respiratory problems related to activity or exercise. Your child will be asked to exercise using a treadmill or stationary bike. This test is performed in coordination with a cardiologist.

Echocardiogram (ECHO)

An echocardiogram is performed by a cardiologist to examine heart function. The test uses an ultrasound probe placed on the chest wall to measure how well the heart is functioning.

Overnight Sleep Study

This is an overnight test that will tell us if your child is having problems breathing during sleep. Problems during sleep may include upper airway obstruction, low oxygen levels and/or high carbon dioxide levels. This test is done in a sleep laboratory. Please ask your healthcare provider for additional details regarding this test.

TREATMENTS AND DEVICES

Common treatments and devices that may be recommended to help your child breathe better are:

Spacers

Spacers are tube-like devices that help medicine get into the child's lower airways. They are used with certain inhalers prescribed by your provider, which may include Albuterol, Atrovent® or an inhaled corticosteroid, such as Flovent®.

Nebulizers

A nebulizer is a machine that turns medicine into a mist that can travel into the lower airways. This device may be used if your child has difficulty with a spacer.

Airway Clearance Devices

Airway clearance devices are used in children who have difficulty clearing sputum or mucus from the lower airways. It can help to bring up thick, sticky secretions to help your child breathe better. Sometimes we test mucus for infections and prescribe treatment if needed.

- **Manual Percussor**
  A caregiver taps on the child's chest with a palm-sized cup. This breaks up mucus in the lungs. If your child needs this therapy, we will teach you how to do it properly.
- **Cough Assist Device**
  This device is used for children who have an ineffective cough due to muscle weakness. It provides a deep breath in followed by a breath out. This pulls secretions into the mouth where they can be swallowed or suctioned out. It can be used daily to help keep airways open and to prevent airway collapse or pneumonia.
- **Therapy Vest**
  A vest is wrapped around your child's chest. It applies pressure and vibration to the chest to loosen mucus and improve breathing. Your child needs an effective cough to bring up the loose mucus from the lower airways.
- **Acapella**
  This is a handheld device used by older children to clear mucus from the lower airways. They need to be able to follow directions to use this device.

Noninvasive Ventilation

These devices are used to help your child breathe. There are two types:

- Continuous Positive Airway Pressure (CPAP): This device helps children with upper-airway obstruction.
- Bi-level Positive Airway Pressure (BLPAP): This device helps with gas exchange. The air we breathe is made up of gases. As we inhale (breathe in), oxygen enters our lungs. The body keeps the oxygen, and carbon dioxide is sent out as we exhale (breathe out). This process is called gas exchange.

Your child will wear a nasal mask with both devices. The mask is connected to a CPAP or BLPAP machine. An overnight sleep study may be done to adjust settings on your child's device.

Clinical Research

Clinical research is an important part of learning more about your child's pulmonary condition and helping to improve outcomes for babies and children with pulmonary conditions. To learn more about what research study opportunities are available, please contact the Pulmonary Research Team at **PulmonaryResearch@chop.edu**.

YOUR CHILD'S CARE TEAM

It can be helpful to keep track of the members of your child's Pulmonary care team:

Provider: _____

Social Worker: _____

Others: _____

Next appointment: _____

NOTES

www.chop.edu/pulmonary

215-590-3749

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