Bronchopulmonary dysplasia (BPD) is a form of chronic lung disease that affects newborns (mostly premature) and infants. It results from damage to the lungs caused by mechanical ventilation (respirator) and long-term use of oxygen. Most infants recover from BPD, but some may have long-term breathing difficulty.

**Learn About Bronchopulmonary Dysplasia**

BPD is a form of chronic lung disease that affects newborns (mostly premature) and infants. In BPD, the lung and the airways (bronchi) are damaged in the neonatal period, causing destruction (dysplasia) of the tiny air sacs of the lung (alveoli).

**Key Facts**

- BPD is associated with inflammation and scarring in the lungs.
- BPD is much more common among low-birth-weight and premature infants.
- Most infants recover from BPD, but some may have long-term breathing difficulty.
- Infants are not born with BPD; the condition results from damage to the lungs caused by mechanical ventilation (respirator) and long-term use of oxygen.
- The severity of BPD is defined by the amount of oxygen an infant requires at time of birth and the length of use of supplemental oxygen or mechanical ventilation.

**What Is BPD?**

Prematurely born infants, especially those born before 28 weeks of gestation, have very few tiny air sacs (alveoli) at birth. The alveoli that are present tend to not be mature enough to function normally, and the infant requires respiratory support with oxygen or mechanical ventilation (a respirator) to support breathing. Although life-saving, these treatments can also cause lung damage, referred to as “broncho [airway] pulmonary [lung] dysplasia,” or BPD.

**How BPD Affects Your Body**

BPD directly affects both the lungs and the rest of the body. In the lungs, a significant number of alveoli become fibrotic (scarred) and stop working. This damage affects not only the existing alveoli but also those that continuously develop after birth. The low number of working alveoli means that the affected infant will need to remain on a breathing machine (ventilator) and/or receive oxygen for an extended period of time. This oxygen can cause further damage.

The damage to the alveoli also causes damage to the blood vessels around them, making the passage of blood through the lungs more difficult. In the long run, this leads to increases in the pressure inside blood vessels in the lungs and between the heart and lungs (pulmonary hypertension) and puts significant strain on the heart, which, in severe cases, may lead to heart failure.

Because of the low number of working alveoli, the affected infant needs to breathe much faster and harder than healthy infants. This work may slow early growth because the infants do not have the energy or the time to feed properly, thus, taking fewer calories in than they should and burning most of the calories just to breathe. This leaves fewer calories for them to grow, with poor growth or “failure to thrive” that in turn may cause problems to other organs of the body.
How Serious Is BPD?
An estimated 10,000 newborns could develop BPD in the United States every year. Its severity varies from infant to infant. In mild cases, the infant may only have a faster than usual respiratory rate. In cases of moderate severity, the infant may require oxygen for several months. In uncommon but severe cases, the infant may have respiratory failure that requires not only oxygen but also prolonged need for mechanical ventilation.

BPD Symptoms, Causes, and Risk Factors
The symptoms of BPD vary depending on its severity. Several risk factors make the development of BPD more likely but do not automatically lead to BPD.

What Are the Symptoms of BPD?
The most common symptoms of bronchopulmonary dysplasia are:
- Rapid breathing
- Labored breathing (drawing in of the lower chest while breathing in)
- Wheezing (a soft whistling sound as the baby breathes out)
- Bluish discoloration of the skin around the lips and nails due to low oxygen in the blood
- Poor growth
- Repeated lung infections that may require hospitalization

What Causes BPD?
The cause of BPD is related to lifesaving oxygen and mechanical ventilation. While a relatively high amount of inhaled oxygen over several days may be necessary to support life, it may also cause damage to the alveoli. This is sometimes made worse when the ventilator blows air into the lung, overstretching the alveoli. Less well understood, inflammation can damage the inside lining of the airways, the alveoli, and even the blood vessels around them. These effects are particularly damaging on the premature lung, and BPD is considered to be primarily a complication of prematurity.

What Are Risk Factors?
There are several conditions that do not cause but make the development of BPD more likely (risk factors) such as the following:
- Degree of prematurity: The less developed the lungs, the more they are likely to be damaged and result in BPD. BPD is rare in infants born after 32 weeks of pregnancy.
- Prolonged mechanical ventilation: Mechanical ventilation stretches the alveoli. When overstretched, and for longer periods of time, they may be damaged.
- High concentrations of oxygen: The higher the concentration of oxygen and longer duration it is given, the higher the possibility of developing BPD. In general, concentrations of less than 60% oxygen are considered to be relatively safe.
- Male gender: Male infants are more likely to be born prematurely and to develop BPD.
- Maternal conditions: Maternal smoking or use of illicit drugs, maternal malnutrition, and infections in the mother during the pregnancy may affect the normal growth of the fetus and may lead to premature labor, development of respiratory distress syndrome, and eventually to BPD.
Other risk factors.

- Patent ductus arteriosus. The ductus arteriosus is a blood vessel that connects the right and left sides of the heart and closes shortly after birth. This vessel is more likely to remain open in premature infants causing lung damage when too much blood flows into the lungs.

- Intrauterine growth retardation (IUGR): Different conditions may affect the growth of the fetus during the pregnancy and may also lead to premature labor. Relatively undeveloped lungs are more likely to develop BPD.

When to See Your Doctor

As infants with BPD usually had oxygen and mechanical ventilation, they are often in the hospital when diagnosed. Regardless, you should contact your pediatrician if:

- Your infant/child is breathing much faster than the usual (a general rule is about 10 to 20 breaths higher than the usual rate).
- The breathing is labored (pulling in of the skin between the ribs, below the chest or at the bottom of the neck just above the chest).
- There is bluish discoloration around mouth or lips.
- There are frequent alarms of the apnea monitor and/or pulse oximeter.

Diagnosing and Treating BPD

There is no specific test for the diagnosis of BPD and no specific cure. However, there are treatments that help prevent, delay, or minimize the symptoms.

How BPD Is Diagnosed

The diagnosis of BPD is based on the infant's clinical situation, how premature he or she is, and the need for oxygen after a certain age. There are no blood tests, and biopsies are not needed.

How BPD Is Treated

Several types of drug therapies may be used to treat BPD:

1. Diuretics: This class of drugs helps to decrease the amount of fluid in and around the alveoli. They are usually given by mouth 1 to 4 times per day.

2. Bronchodilators: These medications help relax the muscles around the air passages, thus making breathing easier by widening the diameter of the airway openings. They are usually given as a mist by a mask over the infant's face and using a nebulizer or an inhaler with a spacer.

3. Corticosteroids: These drugs reduce and/or prevent the inflammation within the lungs. They help reduce swelling within the walls of the windpipes and decrease the amount of mucus that is produced. Like bronchodilators, they are also usually given as an aerosol with a mask, either with use of a nebulizer or an inhaler with a spacer.

4. Viral immunization: Children with BPD are at increased risk from respiratory tract infections, especially respiratory syncytial virus (RSV). Infants with moderate or severe BPD receive monthly injections with a medication that helps prevent the infection during the RSV season.

5. Cardiac medications: A few infants with BPD may require special medications that help relax the muscles around the blood vessels in the lung, allowing the blood to pass more freely to reduce the strain on the heart.
Living With BPD

BPD tends to cause the most symptoms during infancy and early childhood. As affected children grow healthy new lungs, they gradually improve, and by 3 to 5 years of life, most of them are just like normal healthy children of the same age. However, the lungs may not be completely normal and may contribute to problems later in adulthood.

What to Expect

In general, infants with BPD tend to get better as they grow older. This is because most of the lung growth takes place after birth and throughout childhood. However, how fast and to what degree they will get better, as well as the amount and type of care each patient will need, varies.

Infants with mild BPD may not need any special treatment. Others may need medications given either as an aerosol or by mouth either daily or when they get sick.

Premature infants with even mild BPD are at risk for pauses in breathing (apnea), especially during sleep, causing temporary drops in the oxygen levels in the blood and in the heart rate (bradycardia). This is because the part of the brain that controls the breathing is not fully developed until about 44 weeks after the beginning of the pregnancy (in other words, about 1 month after a healthy normal baby is born). Infants with pauses in breathing and low heart rates are often discharged to go home with monitors that continuously check their breathing and heart rate. They may also be sent home with devices that monitor the oxygen levels in the body (pulse oximeters).

Patients with more severe disease may need oxygen given with nasal prongs for several months. They may also need some form of support with a machine that delivers pressure through the nose through special prongs or a mask. These machines provide either continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP). A small number of patients with very severe disease may need a ventilator support for a long time, in which case they will need to receive a tracheostomy (a breathing tube inserted into the lungs through the neck).

It is highly recommended that infants with BPD be evaluated and followed by a pediatric lung specialist at least during the first few years of life.

Infants with BPD do not necessarily get sick more often than other infants. However, they tend to develop more severe symptoms than infants who have the same infections, their recovery lasts longer, and illnesses may set them back in their progress (eg, infants who had been taken off oxygen may require oxygen again). Frequent hospitalizations are common, especially among those with moderate to severe BPD.

Infants with severe BPD frequently experience additional problems, including feeding difficulty (that may be severe enough to require placement of a permanent feeding tube), acid reflux, pulmonary hypertension, neurologic complications, vision or hearing problems, and various learning disabilities. Most of these complications are rare in those with mild to moderate BPD.

The frequent ups and downs in the health of infants with severe BPD can result in challenges for the caretakers who may experience psychological problems (eg, anxiety, depression) of their own.

Managing BPD

Early treatment centers on helping your child’s lungs to develop and preventing respiratory symptoms. You should contact your doctor if your child has a cough, cold, irritability, runny nose, or fever.

Many respiratory infections can be prevented with simple measures, such as washing your hands before you touch the infant and discouraging those who are sick from visiting. It is also important to
follow your doctor’s advice regarding vaccinations for the infant and the siblings, as well as for the caregivers.

Reducing lung irritants, such as cigarette smoke, dust, and pollution, will help the lungs to grow and develop. Don’t allow smoking within the house or anywhere else near the baby.

Most babies with BPD get better over time. As your child’s lungs improve and mature, they will have fewer problems with their breathing. Symptoms can settle down by 2 to 3 years old and may not require any further medical treatment.

Finding Support
Family and friends are great sources of support. Additionally, hospital staff, such as doctors, nurses, case managers, and social workers, will provide useful insight into your child’s needs after leaving the hospital. They may also be able to direct you to support groups for parents of premature infants.

The Lung Association recommends patients and caregivers join our Living with Lung Disease Support Community to connect with others facing this disease. You can also call the Lung Association’s Lung HelpLine at 1-800-LUNGUSA to talk to a trained respiratory professional who can help answer your questions and connect you with additional support.

Questions to Ask Your Doctor About BPD
Learn as much as you can about your child’s daily care. This will help you to identify questions early on. Parents are encouraged to spend time in the ICU to begin to bond with the baby before he or she comes home.

Learn more about BPD from your doctor, and become familiar with the various medications and treatments. Do not hesitate to seek medical care when you think that there is something wrong with your child.

Making notes before your visit, as well as taking along a trusted family member or friend, can help you through the first appointment with your doctor.

Questions that will help clarify and lead to a better understanding of your child’s condition include:

- What is my child’s diagnosis?
- What caused the BPD?
- How severe is my child’s BPD?
- Is there more than one disease or condition that could be causing my child’s symptoms?
- What are the treatment options?
- What are the benefits of each option? What are the side effects?
- Will my child need any further testing?
- What is likely to happen in the short-term and as the baby gets older?
- What will the medicine you are prescribing do?
- How do I fit the care of my child into my daily routine?
- Do I need a follow-up visit for my child and how often?
- Should my child see specialists?
- What can I do about my own health to help keep my baby healthy?

Authors
Mary Cataletto, MD, FCCP • Gurpreet Phull, MD • Prateek Shukla, MD
Anastassios C. Koumbourlis, MD, MPH, FCCP
[chestfoundation.org/patienteducation](http://chestfoundation.org/patienteducation)