Congenital Heart Disease Screening Program
Our goal is simple. We want all infants with critical congenital heart disease to be identified before leaving the nursery. Together, we can achieve this goal and save lives.

The Lasting Impact of Congenital Heart Disease

Congenital heart disease (CHD) is the most common birth defect. Infants with CHD have abnormal heart structure resulting in abnormal blood flow patterns. Approximately eight out of every 1,000 infants have a form of CHD. Some forms of CHD cause no, or very few, problems in the health, growth and development of the infant. In many cases, these forms of CHD do not require surgical repair or cardiac catheterization.

Critical CHD, however, can bring a significant risk of morbidity and mortality if not diagnosed in a timely manner. Failing to detect critical CHD while in the newborn nursery may lead to critical events, such as cardiogenic shock or death. Survivors who present late are at greater risk for neurologic injury and subsequent developmental delay.

Fortunately, a routine test exists that can help us identify most infants with critical CHD.

What is the pulse-oximetry test?

Pulse oximetry is a simple, non-invasive and painless test that is used to measure the percent of oxygen saturation of hemoglobin in the arterial blood and the pulse rate. The pulse-oximetry test was invented in the 1970s and is now widely used and accepted in clinical care. In fact, it is often considered a vital sign. Traditionally, pulse oximetry has been used to monitor an individual’s oxygen saturation during acute and chronic illness, as well as during procedures requiring general anesthesia or sedation.

Why is pulse oximetry used to screen for CHD?

A routine physical examination, as performed during the first 24 hours of life in most institutions, is only 50 percent effective in detecting CHD. The pulse-oximetry test can help identify infants with low levels of oxygen in their blood and may help diagnose critical CHD before an infant becomes sick.

The test has been recommended as a screening test for critical CHD by the:

- U.S. Department of Health and Human Services
- American Heart Association
- American Academy of Pediatrics
- American College of Cardiology

It is important to note, however, that it is possible for a baby with CHD to have a normal pulse-oximetry reading. CHD cannot be completely ruled out by a normal pulse-oximetry reading.

Who should be screened?

All infants should be screened.

When should screening be performed?

Pulse-oximetry screening should be performed after the infant turns 24 hours of age and before discharge from the nursery. If the infant was born prematurely, screening should be performed when medically appropriate to do so. If early discharge is planned, screening should occur as late as possible.

Where should screening be performed?

The pulse-oximetry test should be performed on the right hand and one foot.

What is a normal pulse-oximetry reading for infants?

A reading of 95 to 100 percent is normal in healthy infants. Infants with heart or lung problems may have lower readings. A low pulse-oximetry reading can also be present in newborns whose circulation is adjusting to life outside of the womb.
It is recommended that pulse-oximetry screening be done in conjunction with other standard-of-care newborn screening that requires the infant be at least 24 hours of age, such as metabolic or hearing screening.

If the newborn's oxygen saturation is ≥95 percentage points in either extremity with a ≤3 percentage-point difference between the two, he or she will be considered to have passed the screening test and no additional evaluation will be required unless other signs or symptoms of CHD are present.

If the newborn's oxygen saturation is <90 percentage points in either the hand or foot, he or she should be immediately referred for additional evaluation.

If the oxygen saturations are <95 percentage points in both the hand and foot or there is a >3 percentage-point difference between the hand and foot on three measures, each separated by one hour, the newborn should be referred for additional evaluation.

Overview of Screening Guidelines

Testing Dos
1. If you are using disposable pulse-oximetry probes, use a new, clean probe for each infant. If you are using reusable pulse-oximetry probes, clean the probe with recommended disinfectant solution between each infant. Dirty probes can decrease the accuracy of your reading and can transmit infection. A disposable wrap should be used to secure the probe to the site.

2. The best sites for performing pulse oximetry on infants are around the palm and the foot. An infant pulse-oximetry probe (not an adult pulse-oximetry clip) should always be used for infants.

3. When placing the sensor on the infant’s skin, there should not be gaps between the sensor and the infant’s skin. The sides of the probe should be directly opposite each other.

4. Nail-polish dyes and substances with dark pigmentation (such as dried blood) can affect the pulse-oximetry reading. Assure that the skin is clean and dry before placing the probe on the infant. Skin color and jaundice do not affect the pulse-oximetry reading.

5. Movement, shivering and crying can affect the accuracy of the pulse-oximetry reading. Ensure that the infant is calm and warm during the reading. Swaddle the infant and encourage family involvement to promote comfort while obtaining the reading. If possible, conduct screening while the infant is awake.

6. Pulse oximeters have different confidence indicators to ensure that the pulse-oximetry reading is accurate. Determine the confidence indicators for the pulse-oximetry equipment that you are using.

Performing Pulse Oximetry with the Infant Patient

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7. If an infant requires pulse-oximetry monitoring for an extended amount of time, assess the site where the probe is placed at least every two hours. Monitor for signs of irrigation and burning of the skin.

Testing Don’ts
1. Never use an adult pulse-oximetry clip when obtaining a reading for an infant. Using an adult clip on an infant will give an inaccurate reading.

2. Blood flow is needed to obtain an accurate pulse-oximetry reading. Never attempt to obtain a reading on the same extremity that you have an automatic blood pressure cuff.

3. Bright or infrared light, including bilirubin lamps and surgical lights, can affect the accuracy of the reading. Ensure that the infant is not placed in bright or infrared light while the test is being performed. You may cover the pulse-oximetry probe with a blanket to ensure that extraneous light does not affect the accuracy of your reading.

4. Do not use tape to apply the pulse-oximetry probe to the infant’s skin.

Testing Cautions
1. The pulse is needed to determine the oximetry reading. Pulse oximetry is not accurate if the patient is coding or is having a cardiac arrhythmia. Remember: No pulse, no oximetry!

2. Pulse-oximetry readings are not instantaneous. The oximetry reading that is displayed on the monitor is an average of readings over the past few seconds.
### Screening Recommendations

1. Pair pulse-oximetry screening with another standard-of-care screening performed following 24 hours of age, such as metabolic or hearing screening. If early discharge is planned, screening should occur as late as possible.

2. Consider assigning one or two nursing assistants or registered nurses to pulse-oximetry screening on a daily basis. If possible, provide continuity by scheduling one screener to conduct screening on several continuous days.

3. Conduct screening in a quiet area with parent present to soothe and comfort the infant.

4. If possible, conduct screening while the infant is awake, quiet and calm.

5. Do not attempt to perform pulse oximetry on an infant while he or she is sleeping, crying or cold, as oxygen saturations may be affected.

6. If using disposable pulse-oximetry probes, use one clean probe for each infant screened. If reusable probes are being used, clean probe as instructed by manufacturer prior to and following screening. Dirty probes may decrease the accuracy of a reading or transmit infection.

7. Perform pulse oximetry on the right hand and one foot after 24 hours of age. Measurements should be taken in parallel or one after another. If infant was born prematurely, perform screening when medically appropriate.

8. Ensure that all readings are accurate by using pulse-oximetry equipment confidence indicators.

9. If the oxygen saturation is ≥95 percentage points in either extremity with a ≤3 percentage-point difference between the two, the infant will “pass” the screening test and no additional evaluation will be required unless other signs or symptoms of CHD are present.

   a. The physician or nurse practitioner caring for the infant does not need to be notified.

   b. The infant does not require additional cardiac evaluation in the newborn nursery unless indicated.

10. If the pulse-oximetry reading is <90 percentage points in either the hand or foot, the infant should be immediately referred to his or her physician for additional evaluation.

11. If the oxygen saturations are <95 percentage points in both the hand and foot or there is a >3 percentage-point difference between the two within three measures, each separated by one hour, the newborn should be referred for additional evaluation.

   a. The infant’s physician or nurse practitioner should be notified.

   b. Infectious and pulmonary pathology should be excluded.

   c. If cause of hypoxemia is not clear, an echocardiogram and cardiology consultation should be obtained, if available, to rule out congenital heart disease. If echocardiogram and/or cardiology consultation are not available, the infant should be transferred to Nationwide Children’s (or your local neonatal ICU consultation service) for further evaluation.

   d. Further evaluation should be ordered at the discretion of the physician or nurse practitioner caring for the infant.

### Screening Protocol

**Pulse Oxon Right Hand (RH) and One Foot After 24 Hours of Age**

- **Pulse Ox ≥95 Percentage Points (both RH & foot)**: Do not proceed to 10.
- **Pulse Ox ≥95 Percentage Points (RH or Foot) & Difference of ≤3 Percentage Points Between RH and Foot**
  - **Pulse Ox ≥95 Percentage Points (RH or Foot)**: Proceed to 11.
  - **Pulse Ox ≥95 Percentage Points Between RH and Foot**
    - Repeat Pulse Ox in 1 Hour
      - If **Pulse Ox ≥95 Percentage Points (RH or Foot)** & Difference of ≤3 Percentage Points Between RH and Foot: **PASS**
      - If **Pulse Ox <95 Percentage Points (RH or Foot)**: **FAIL**
      - **Repeat Pulse Ox in 1 Hour**
      - If **Pulse Ox ≥95 Percentage Points (RH or Foot)** & Difference of ≤3 Percentage Points Between RH and Foot: **PASS**
      - If **Pulse Ox <95 Percentage Points (RH or Foot)**: **FAIL**
    - **Clinical Assessment**
      - **FAIL**

**Assessment of Babies with Failing Saturation**

1. Babies with saturations of <90 percentage points in RH or foot should have immediate assessment.
2. Babies with failing saturations:
   - **FAIL**
     - Complete echocardiogram or transfer to Nationwide Children’s.

### If screening fails, call the Physician Direct Connect Line at (614) 355-0221 or (877) 355-0221 and ask for Neonatology. If you have a local neonatology ICU resource, please contact your usual consultation service.
The Heart Center

The Heart Center at Nationwide Children's Hospital has earned an international reputation for innovation and forward thinking. From the creation of the world's first Hybrid Cardiac Catheterization Suites and the first Hybrid Congenital Cardiac Operating Room in the nation, to the development of a comprehensive adolescent and adult congenital heart disease program, The Heart Center team is constantly looking to improve care options. Recently ranked in the Top 10 by U.S. News & World Report for Cardiology and Heart Surgery, you can be assured that your patients have access to expertise and resources that can handle any level of care necessary. The Heart Center, out in front, by your side.

Contact Us
Website: NationwideChildrens.org/HeartCenter
Call: (614) 722-2530
Physician Direct Connect Line: (614) 355-0221 or (877) 355-0221

Neonatology

The Section of Neonatology at Nationwide Children's has become one of the largest neonatal networks in the country, treating and serving neonatal medicine, feeding disorders, fetal diagnostics, NICU and BPD. Our goal is to establish the resources and expertise necessary to provide extraordinary, family-centered care. By striving to become the best, we grew to become one of the largest. Our team of rigorously trained neonatologists, advanced practice nurses, staff nurses and other health care specialists provide around-the-clock treatment for newborns. Our programs provide state-of-the-art capabilities for the diagnosis, treatment and follow-up of extremely premature and medically fragile neonates.

Contact Us
Website: NationwideChildrens.org/Neonatology
Physician Direct Connect Line: (614) 355-0221 or (877) 355-0221