

Newborn Screening Program



Implementing Pulse Oximetry Screening For Critical Congenital Heart Disease



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TABLE OF CONTENTS

INTRODUCTION	1
SECTION 1 ~ SCREENING	2
Supplies for Screening	3
Screening Protocol Overview	4
Screening Algorithm	5
SECTION 2 ~ SCREENER TRAINING	6
Training Recommendations.....	7
Pulse Oximetry Probe Placement	8
Helpful Hints when Screening Newborns.....	9
Knowledge Assessment and Answer Key	10
Competency Evaluation Examples	12
SECTION 3 ~ REPORTING	15
Reporting Form Instructions.....	16
Documentation Example	17
SECTION 4 ~ EDUCATION	18
Provider Education.....	19
Program Overview PowerPoint Presentation.....	20
Parent Education Recommendation	21
Newborn Screening Parent Pamphlet	22
Patient and Families FAQ's (English)	23
Patient and Families FAQ's (Spanish)	24
SECTION 5 ~ RESOURCES	25
Children's National Medical Ctr. Heart Smart Video	26
CDC Information: Critical Congenital Heart Defects	27
REFERENCES	29



INTRODUCTION

The State of Tennessee has added Critical Congenital Heart Disease (CCHD) to the current newborn screening panel. Tennessee rules and regulations state that all administrators of hospitals and birthing facilities and medical personnel from nonbirthing facilities will be responsible for ensuring all newborns in their facility are screened. U.S. Department of Health and Human Services Secretary Kathleen Sebelius endorsed the inclusion of screening for CCHD in the recommended uniform screening panel for newborns. The American Heart Association, American Academy of Pediatrics and American College of Cardiology also support newborn pulse oximetry screening for CCHD.

According to the Centers for Disease Control and Prevention (CDC), congenital heart defects account for 24% of infant deaths due to birth defects. In the United States, about 4,800 (or 11.6 per 10,000) babies born every year have CCHDs. Early detection of CCHD can potentially improve the prognosis and decrease the mortality and morbidity rate of affected infants. Pulse oximetry has been investigated and proven to be successful in detecting some forms of CCHD in the newborn nursery.

There are seven specific defects targeted through CCHD screening:

- * Hypoplastic left heart syndrome
- * Tetralogy of Fallot
- * Transposition of the great arteries
- * Truncus arteriosus
- * Pulmonary atresia (with intact septum)
- * Total anomalous pulmonary venous return
- * Tricuspid atresia

This screening program adds pulse oximetry testing to routine testing performed on all infants. The test should be performed after the infant turns 24 hours of age, or when medically appropriate if the infant was born prematurely. If early discharge is planned, screening should occur as late as possible. 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. The screen is point-of-care test. Point-of care testing refers to those tests administered outside of a laboratory but close to the site of direct delivery of medical care for a patient. Intervention will take place at the hospitals and birthing facilities if the infant fails the pulse oximetry test.

This manual serves as a guide to assist each birthing facility to establish its own policy and procedures to implement CCHD Screening. These policies and procedures should establish clear, complete, and concise evidence-based policy and address the components listed below:

- * Equipment
- * Training
- * Screening
- * Education



SECTION I / *Screening*

- *Supplies for Screening*
- *Screening Protocol Overview*
- *Screening Algorithm*

SUPPLIES FOR SCREENING

- **PULSE OXIMETERS**

1. At least one to be used for screening
2. One pulse oximeter for back-up

Each birthing facility will be responsible for selecting and securing pulse oximeter equipment for screening newborns for CCHD, if appropriate equipment is not already available. Such equipment must be compliant with national standards:

- ◆ Must have been cleared by the FDA for use in newborns.
- ◆ Must be calibrated regularly based on manufacturer guidelines.

- **INFANT DISPOSABLE OR REUSABLE PULSE OX SENSORS**

1. If using disposable sensors, one disposable sensor for every infant screened
2. If using reusable sensors, one reusable sensor for each pulse oximeter.

Also consider additional reusable sensors for back-up

- ◆ a. Disinfecting agent recommended by pulse oximetry equipment manufacturer

3. One disposable wrap per infant screened to secure sensor to hand or foot

- **ROLLING CART FOR SUPPLIES**

- **DATA COLLECTION FORMS (FILTER CARD)**

1. One for every infant screened

- **TRAINED INDIVIDUALS TO PERFORM SCREENING**

- **BLANKETS FOR WARMING THE INFANT AND BLOCKING EXTRANEIOUS LIGHT**

- **A PARENT FOR COMFORTING INFANT DURING SCREENING (OPTIONAL)**



SCREENING PROTOCOL OVERVIEW

This screening program adds pulse oximetry testing by an FDA approved pulse oximeter on all infants. The test should be performed on all infants between 24-48 hours of age. If early discharge is planned, screening should occur as late as possible. 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.

The initial screen will be done in the foot only (left or right). If the oxygen saturation in the foot is <90% the newborn fails the screen. An oxygen saturation from the foot of 97-100% is an immediate pass and does not require a right hand saturation. If the oxygen saturation in the foot is 90-96% the right hand will also be screened.

To pass the screen, the newborn must register an oxygen saturation of $\geq 95\%$ on either the right hand or the foot (left or right) and a difference of $\leq 3\%$ between the right hand and foot*. Pass does not exclude the existence of a cardiac disorder. If cardiac evaluation is otherwise indicated (e.g., clinical signs, prenatal diagnosis of critical congenital heart disease, dysmorphic features, etc.), proceed with cardiac evaluation even if baby receives a pass on the pulse oximetry screen.

The newborn fails the screen if the oxygen saturation is <90% on the hand or foot at anytime during screening. The newborn also fails the screen if the oxygen saturations are <95% in both the right hand and the foot (left or right) or there is a >3% difference between the right hand and foot* on three measures separated by one hour. A newborn with a failed screening should be referred for additional evaluation.

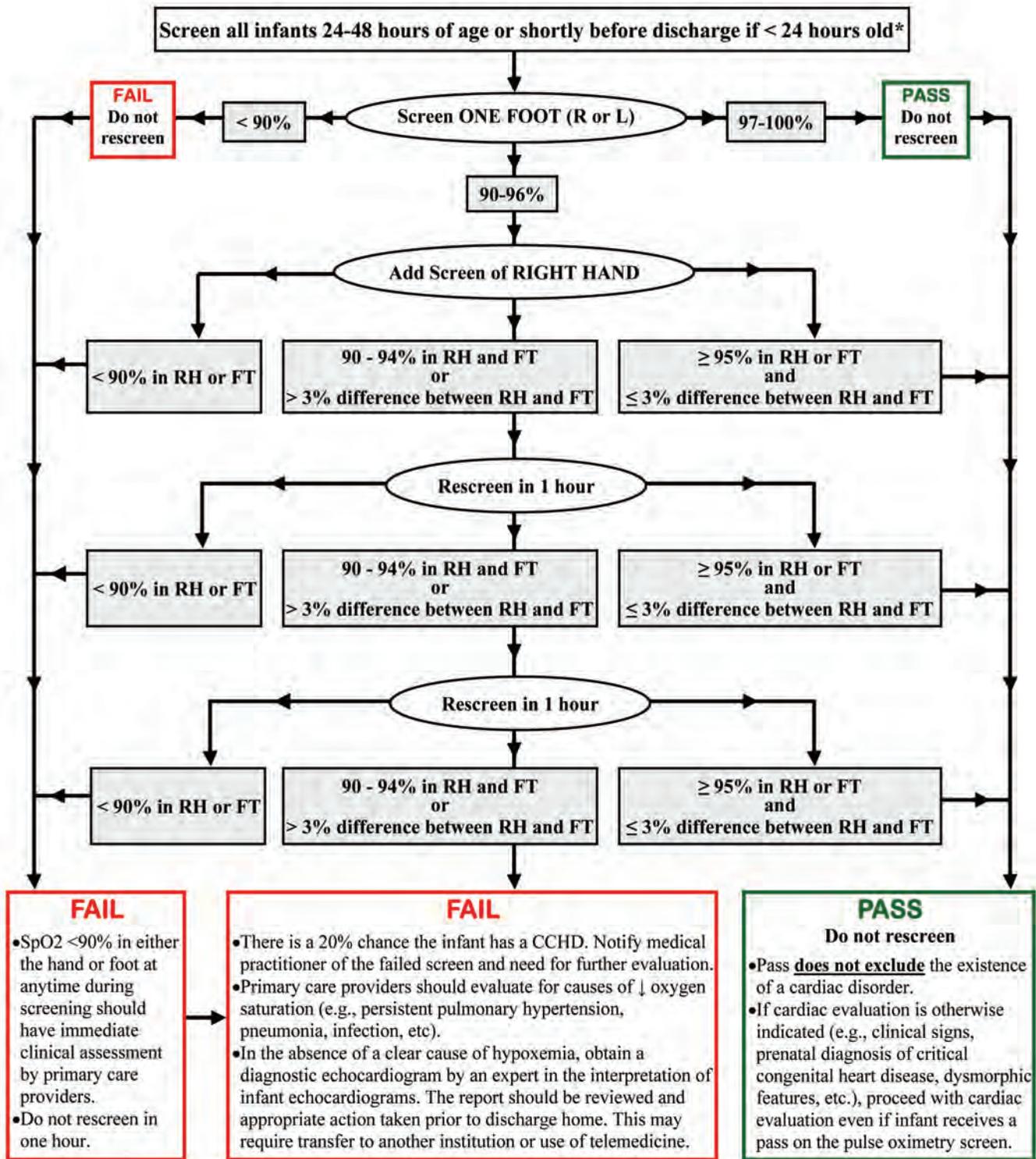
*Chart for identifying infants with > 3% difference between the right hand and foot:

		FOOT											
		100	99	98	97	96	95	94	93	92	91	90	<90
RIGHT HAND	100	100	99	98	97	96	95	94	93	92	91	90	<90
	99	100	99	98	97	96	95	94	93	92	91	90	<90
	98	100	99	98	97	96	95	94	93	92	91	90	<90
	97	100	99	98	97	96	95	94	93	92	91	90	<90
	96	100	99	98	97	96	95	94	93	92	91	90	<90
	95	100	99	98	97	96	95	94	93	92	91	90	<90

Right hand screening not needed if foot saturation is 97-100%



Protocol for Critical Congenital Heart Disease (CCHD) Screening Tennessee Department of Health



- Optimal results are obtained by pulse oximeter that has been cleared by FDA for use in newborn.
- This screening algorithm should not take the place of clinical judgment or customary clinical practice.

RH = Right Hand FT = Foot SpO₂ = Saturation of Peripheral Oxygen

*Infants in special care nurseries (including intermediate care and neonatal intensive care, etc.) should be screened at 24-48 hours of age or when medically appropriate after 24 hrs of age. In all cases, screening should occur prior to discharge from the hospital.



SECTION 2 / Screener Training

- Training Recommendations
- Pulse Oximetry Probe Placement
- Helpful Hints when Screening Newborns
- Knowledge Assessment Tool and Answer Key
- Competency Evaluation Examples

TRAINING RECOMMENDATIONS

This manual serves as a guide to assist each birthing facility to establish its own policy and procedures to implement Critical Congenital Heart Disease Screening. The following is a list of educational tools and components that may be used to educate staff who will be directly involved in screening implementation. These tools are included in this manual.

Education for Providers:

- The provider education fact sheet (pg. 19) includes an overview of pulse oximetry, congenital heart disease, and pulse oximetry screening for critical congenital heart disease.
- Children’s National Medical Center “Heart Smart” Video Series (pg. 26).

PowerPoint Presentation:

- Provides attendees with education on background, significance, and need for screening (pg. 20).

Pulse Oximetry Demonstration:

- Provide all training prior to implementation of the screening program by an individual who has participated in the planning process.
- Provide attendees with a demonstration of correct and safe use of pulse oximetry equipment in obtaining an accurate infant reading by in-service facilitator or representative from pulse oximeter manufacturer.
- Provide attendees with an opportunity to practice performing pulse ox screening.
- Provide attendees with the opportunity to ask questions regarding correct and safe methods for performing pulse ox screening.
- Provide attendees with the “Pulse Ox Probe Placement” (pg. 8) and “Helpful Hints when Screening Newborns” (pg. 9) educational tools.

Knowledge Assessment Quiz:

- Allow time for attendees to complete the “Knowledge Assessment” (pg. 10)
- Review the correct answer for each question.
- Allow time for remediation of questions answered incorrectly.
- Allow time for attendees to re-take assessment, if necessary.

Competency Evaluation:

- Allow adequate time for completion of competency evaluation (pg. 12-14).
- Provide each attendee with a copy of the complete competency evaluation to forward to his or her manager.



PULSE OXIMETRY PROBE PLACEMENT



Right Hand Application



Foot Application

1. Select application site on the outside, fleshy area of the infant's hand or foot.
2. Place the photodetector portion of the probe on the fleshy portion of the outside of the infant's hand or foot.
3. Place the light emitter portion of the probe on the top of the hand or foot. Place the photodetector directly opposite of light emitter, on the bottom of the hand or foot.
4. Remember: The photodetector and emitter must be directly opposite each other in order to obtain an accurate reading.
5. Secure the probe to the infant's hand or foot using the adhesive or foam tape recommended by the vendor. It is not recommended to use tape to secure probe placement.
6. Some vendors use visual images such as a star or bar to specify which side of the probe should be placed on top of the hand or foot. You may choose to use a helpful statement such as, "Raise the bar" or "Star to the Sky" to help you to remember proper probe placement.



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HELPFUL HINTS WHEN SCREENING NEWBORNS

Pulse Ox – Dos

- If you are using disposable pulse ox probes, use a new, clean probe for each infant. If you are using reusable pulse ox 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.
- The best sites for performing pulse ox on infants are around the palm and the foot. An infant pulse ox probe (not an adult pulse ox clip) should always be used for infants.
- 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 of each other.
- Substances with dark pigmentation (such as dried blood) can affect the pulse ox 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 ox reading.
- Movement, shivering and crying can affect the accuracy of the pulse ox 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.
- Pulse oximeters have different confidence indicators to ensure that the pulse ox reading is accurate. Determine the confidence indicators for the pulse oximetry equipment that you are using.

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

Pulse Ox – Don'ts

- Never use an adult pulse ox clip when obtaining a pulse ox reading for an infant. Using an adult clip on an infant will give you an inaccurate reading.
- Blood flow is needed to obtain an accurate pulse ox reading. Never attempt to obtain a pulse ox reading on the same extremity that you have an automatic blood pressure cuff.
- 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 pulse ox is being performed. You may cover the pulse ox probe with a blanket to ensure that extraneous light does not affect the accuracy of your reading.
- Do not use tape to apply the pulse ox probe to the infant's skin.

Pulse Ox - Caution!

- The pulse is needed to determine the oximetry reading. Pulse ox is not accurate if the patient is coding or is having a cardiac arrhythmia. **REMEMBER: No pulse, no oximetry!**
- Pulse ox readings are not instantaneous. The oximetry reading that is displayed on the monitor is an average of readings over the past few seconds.



KNOWLEDGE ASSESSMENT

1. THE FOLLOWING CAN AFFECT THE ACCURACY OF THE PULSE OXIMETRY (PULSE OX) READING:
 - a. Movement
 - b. Cold extremities or shivering
 - c. Crying
 - d. Bilirubin lamps and surgical lights
 - e. All of the above
2. ONE CLEAN, DISPOSABLE PULSE OX PROBE CAN BE USED ON UP TO FIVE PATIENTS.
 - a. True
 - b. False
3. ALL OF THE FOLLOWING CAN AFFECT THE ACCURACY OF THE PULSE OX READING EXCEPT:
 - a. Placing the pulse ox probe on the same extremity that you are taking the blood pressure
 - b. Performing the pulse ox test while the infant is crying
 - c. Using a clip on the finger of an infant
 - d. Infant skin color or jaundice
4. PULSE OX SCREENING WILL DETECT ALL FORMS OF CONGENITAL HEART DISEASE:
 - a. True
 - b. False
5. THE PROTOCOL STATES THAT IF THE PULSE OX READING IS $>97\%$ DURING THE INITIAL SCREEN OF THE FOOT ONLY IT IS AN IMMEDIATE PASS AND DOES NOT REQUIRE A RIGHT HAND SATURATION:
 - a. True
 - b. False
6. PULSE OX SCREENING SHOULD BE PERFORMED WHEN THE INFANT IS WHAT AGE?
 - a. Less than 8 hours
 - b. Between 8 hours and 18 hours
 - c. Greater than 24 hours
 - d. Less than 24 hours
7. AN INFANT'S PULSE OX READINGS SHOULD BE REPORTED TO THE PRIMARY CARE PROVIDER CARING FOR THE INFANT IF:
 - a. Pulse ox readings are 95% or greater for both right hand and one foot and there is a difference of 4 or more between the two on three measures each separated by one hour
 - b. Pulse ox readings are less than 95% for both right hand and one foot or there is a difference of 4 between the two on three measures each separated by one hour
 - c. Pulse ox reading is less than 90% for either or both the right hand and one foot
 - d. All of the above
8. AN INFANT'S PULSE OX SCREENING READING IS 92% IN THE FOOT AND 95% IN THE RIGHT HAND. DOES THE INFANT PASS OR FAIL THE SCREEN?
 - a. Pass
 - b. Fail



KNOWLEDGE ASSESSMENT

1. THE FOLLOWING CAN AFFECT THE ACCURACY OF THE PULSE OXIMETRY (PULSE OX) READING:
 - a. Movement
 - b. Cold extremities or shivering
 - c. Crying
 - d. Bilirubin lamps and surgical lights
 - e. All of the above**
2. ONE CLEAN, DISPOSABLE PULSE OX PROBE CAN BE USED ON UP TO FIVE PATIENTS.
 - a. True
 - b. False**
3. ALL OF THE FOLLOWING CAN AFFECT THE ACCURACY OF THE PULSE OX READING EXCEPT:
 - a. Placing the pulse ox probe on the same extremity that you are taking the blood pressure
 - b. Performing the pulse ox test while the infant is crying
 - c. Using a clip on the finger of an infant
 - d. Infant skin color or jaundice**
4. PULSE OX SCREENING WILL DETECT ALL FORMS OF CONGENITAL HEART DISEASE:
 - a. True
 - b. False**
5. THE PROTOCOL STATES THAT IF THE PULSE OX READING IS >97% DURING THE INITIAL SCREEN OF THE FOOT ONLY IT IS AN IMMEDIATE PASS AND DOES NOT REQUIRE A RIGHT HAND SATURATION:
 - a. True**
 - b. False
6. PULSE OX SCREENING SHOULD BE PERFORMED WHEN THE INFANT IS WHAT AGE?
 - a. Less than 8 hours
 - b. Between 8 hours and 18 hours
 - c. Greater than 24 hours**
 - d. Less than 24 hours
7. AN INFANT'S PULSE OX READINGS SHOULD BE REPORTED TO THE PRIMARY CARE PROVIDER CARING FOR THE INFANT IF:
 - a. Pulse ox readings are 95% or greater for both right hand and one foot and there is a difference of 4 or more between the two on three measures each separated by one hour
 - b. Pulse ox readings are less than 95% for both right hand and one foot or there is a difference of 4 between the two on three measures each separated by one hour
 - c. Pulse ox reading is less than 90% for either or both the right hand and one foot
 - d. All of the above**
8. AN INFANT'S PULSE OX SCREENING READING IS 92% IN THE FOOT AND 95% IN THE RIGHT HAND. DOES THE INFANT PASS OR FAIL THE SCREEN?
 - a. Pass**
 - b. Fail

COMPETENCY EVALUATION *Example 2*

Name: _____ Dept. #: _____ Employee #: _____ Hire/Evaluation Date: _____

Step 1: Competence means "able to perform the procedure safely, correctly, effectively, and legally". Performance of skills includes decision-making, assessment, and application of knowledge. Team member completes the self-assessment using the code below.	Step 2: Required for all direct patient care providers		Step 3: Using the codes below, note the method used to validate, then document the age group in specific terms. You may also use this column to note exceptional performance or areas for improvement.	Step 4: This is the final step in the competency evaluation process.
	SELF-ASSESSMENT	AGE SPECIFIC		
PROCEDURE OR SKILL	0	1	2	FINAL PROOF OF COMPETENCY
				Date
				Signature
Pulse Oximeter				
Obtains the correct sensor:				
a.) OXI-P/I for placement on infant's great toe				
b.) OXI-A/N for placement on infant's hand or foot				
Obtains correct adhesive wrap:				
a.) ADH-P/I for use with OXI-P/I				
b.) ADH-A/N for use with OXI-A/N				
Identifies correct placement site				
a.) OXI-P/I placed around the great toe with the cable positioned along the side of the foot				
b.) OXI-A/N placed on the foot proximal to the toes with the cable positioned along the sided of the foot, or around the palm of the hand with the cable positioned along the side of the hand				
Cleans and dries the application site				
Applies sensor and adhesive wrap				
Attaches sensor to pulse oximeter and assesses for proper waveform				
Demonstrates proper procedure for sensor cleaning				
a.) Wipes all surfaces of the sensor and cable with a disinfectant solution				
b.) Wipes all surfaces of the sensor and cable with water				
c.) Wipes the sensor and cable dry with a clean, dry gauze pad				
Screening Protocol				
Identifies screening criteria:				
a.) Newborns who are at least 24 hours of age				

Code for Self Assessment:	Code for Age Specific Competencies:			Code for Method:
0 = No previous experiences 1 = Some experience; may require some supervision or assistance 2 = Can perform independently	0 = Neonate (0-1 Mth) 1 = Infant (1-12 Mth) 11 = Child (1-11 Yr)	12 = Adolescent (12-17 Yr) 18 = Adult (18-64 Yr) 65 = Geriatric (>64 Yr)	Blank = Non Age Specific	O = Observation S = Simulation C = Cognitive (test)



COMPETENCY EVALUATION Example 2

PROCEDURE OR SKILL	SELF-ASSESSMENT		AGE SPECIFIC	METHOD	COMMENTS	FINAL PROOF OF COMPETENCY	
	0	1 2				Date	Signature
Screening procedure:							
a.) Measures the oxygen saturation using pulse oximetry with the sensor placed on the infant's right hand and either foot							
b.) Maintains the sensor placement on each site until a stable reading is obtained							
c.) Records the highest oximeter reading obtained from each site in the infant's medical record							
d.) Follows the Congenital Heart Disease Screening algorithm to determine the necessity of additional pulse oximetry assessments based upon the results obtained.							

INSTRUCTIONS

The INITIAL EVALUATION = ALL skills included in the position. To be completed during the Introductory Period and submitted to HR with the Progress Report.

The ANNUAL EVALUATION = Specific skills (5-10) determined by the manager essential to be evaluated each year. These would include high risk, low volume, problem prone, or frequently used skills that are vital. To be completed throughout the year as skills are observed by a manager or designee. The completed form will be attached to the Annual Performance Evaluation and submitted to HR.

STEP 1:

The manager will determine the procedures/skills to be assessed and list them as concisely as possible. These should be specific to the position and include hands-on skills that can be measured as well as skills such as decision-making, assessments, and application of knowledge.

The Self-Assessment is completed by the team member who determines and records their level of competency for each skill.

STEP 2:

This section is required ONLY for DIRECT PATIENT CAREGIVERS. The manager should determine that a skill is age-specific and if so, the appropriate ages for that position.

STEP 3:

Using the code, the method of evaluation is marked. The Comment section should be used to:

1. (if age specific) state the specific age observed. Notes should reflect that each age group designated is observed.
2. Document excellent performance.
3. Document improvements needed.

STEP 4:

Final Proof of Competency must be completed. EACH SKILL must be dated and signed by the manager or designee. Signature indicates the individual is declared competent by the person signing and dating. Some skills may be evaluated in a Skills Lab or similar simulation, but vital skills must be OBSERVED in the clinical or work setting before check off.

Code for Self Assessment:

- 0 = No previous experiences
- 1 = Some experience; may require some supervision or assistance
- 2 = Can perform independently

Code for Age Specific Competencies:

- 0 = Neonate (0-1 Mth)
- 1 = Infant (1-12 Mth)
- 11 = Child (1-11 Yr)
- 12 = Adolescent (12-17 Yr)
- 18 = Adult (18-64 Yr)
- 65 = Geriatric (>64 Yr)

Code for Method:

- O = Observation
- S = Simulation
- C = Cognitive (test)

SECTION 3 / *Reporting*

- *Reporting Form Instructions*
- *Document Example*

REPORTING FORM INSTRUCTIONS

- Perform screen at 24-48 hours of age or shortly before discharge if <24 hours old.
- Screen foot only (either foot) and document date and time in area for initial screen:
 - * If 97 - 100%: Mark PASSED on form. No further testing needed.
 - * If <90%: Mark FAILED.
 - * If 90-96%: Add the screening of the Right Hand.
- If both RH and Foot need to be screened, note it on the collection form:
Mark PASSED if:
 - * $\geq 95\%$ in either extremity with a $\leq 3\%$ difference between the two measures.
Mark FAILED if:
 - * <90% in either the RH or the foot at anytime. Babies should have IMMEDIATE CLINICAL ASSESSMENT.
 - * <95% in both the RH and the foot or a >3% difference between RH and foot on three measures each separated by one hour.

Example:

- ◆ If measurements are <95% in both the RH and foot or there is a >3% difference between the two:
 - ▶▶ Perform a second screen in one hour
- ◆ If the second measurements are:
 - <95% in both the RH and foot or >3% difference between the RH and foot
 - ▶▶ Perform a third screen in one hour
- ◆ If the third measurements are:
 - <95% in both the RH and foot or >3% difference between the RH and foot
 - ▶▶ Then mark FAILED

Example of pulse oximetry screening fields from the filter card:

PULSE OXIMETRY (>24 hours of age)	
SEE BACK OF FILTER FORM FOR SCREENING INSTRUCTIONS	
Initial O2 Screen Date/Time:	
____/____/____ @ (____:____)	MIL TIME
Both upper and lower extremities tested? (____)Y (____)N	
Final Result: Passed (____) Failed (____)	
Referred to Cardiology: (____)Y (____)N	

DOCUMENTATION EXAMPLE

The State of Tennessee only requires the screener to document date and time of the initial screen, whether both upper and lower extremities were screened, if the infant passed or failed the screen and if a referral to cardiology was made (pg. 16).

Documentation of the SpO₂ is not required by the State when reporting but may be requested by the practitioner if questionable. Therefore, your facility may choose to document SpO₂ values for all screens performed. Below is an example for documentation to assist you.

Initial - Foot Only Screen

Date Time

Initial Foot Only: ____/____/____ @ ____:____ SpO₂:____% (97-100%)

- * An oxygen saturation from the foot (left or right) of 97-100% is an immediate pass and does not require a right hand saturation.
- * If the oxygen saturation in the foot is <90% it an automatic fail.
- * If the oxygen saturation in the foot is 90-96% the right hand will also be screened.

Right Hand and Foot (Left or Right) Screen

Date Time RH% Foot% Diff%

First: ____/____/____ @ ____:____ _____ _____ _____

If the RH and foot is <95% or the difference between the two is >3%, perform 2nd screen in 1 hour

Second: ____/____/____ @ ____:____ _____ _____ _____

If the RH and foot is <95% or the difference between the two is >3%, perform 3rd screen in 1 hour

Third: ____/____/____ @ ____:____ _____ _____ _____

If the RH and foot is <95% or the difference between the two is >3%, mark fail

- * The newborn fails the screen if the oxygen saturation is <90% on the hand or foot at anytime during screening.
- * To pass the screen, the newborn must register an oxygen saturation of $\geq 95\%$ on either the right hand or the foot (left or right) and a difference of $\leq 3\%$ between the right hand and foot.
- * A newborn with a failed screening should be referred for additional evaluation.



SECTION 4 / Education

- *Provider Education*
- *Program Overview PowerPoint Presentation*
- *Parent Education Recommendations*
- *Newborn Screening Parent Pamphlet*
- *Patient and Families FAQ's (English)*
- *Patient and Families FAQ's (Spanish)*

PROVIDER EDUCATION

What is pulse oximetry?

Pulse oximetry, or “pulse ox,” is a simple, non-invasive and painless test that is used to measure the percent oxygen saturation of hemoglobin in the arterial blood and the pulse rate. Pulse ox was invented in the 1970s and is now widely used and accepted in clinical care. It is often thought to be a basic vital sign. Traditionally, pulse ox 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.



What is a normal pulse ox reading for infants?

A pulse ox 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.

What is congenital heart disease?

Congenital heart disease (CHD) is the most common birth defect. Infants born with CHD have abnormal structure to their heart which creates abnormal blood flow patterns. Approximately eight of every 1,000 babies born have a form of CHD.

Some forms of CHD cause no or very few problems in the health, growth, and development of the infant. Many times, these forms of CHD do not require surgical repair or cardiac catheterization. However, critical CHD can bring a significant risk of morbidity and mortality. This risk is greater if an infant is not diagnosed soon after birth.

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.

Why is pulse ox used to screen for CHD?

Physical examination is performed during the first 24 hours of life in most institutions and currently the only method used to screen for CHD. Physical examination is only 50 percent effective in detecting CHD after the baby is born.

Pulse oximetry has been recommended by the US Department of Health and Human Services, the American Heart Association, the American Academy of Pediatrics and the American College of Cardiology as a potential screening test for critical CHD. It has been shown to increase the chances that infants with critical CHD are identified before leaving the newborn nursery.

It is possible that a baby with CHD can have a normal pulse ox reading? Yes, CHD can not be completely ruled out by a normal pulse oximetry reading.

PROGRAM OVERVIEW

POWERPOINT PRESENTATION



Newborn Screening Program

TENNESSEE
DEPARTMENT OF
HEALTH

Critical Congenital
Heart Disease
Screening in Tennessee



1

health.tn.gov/MCH/NBS.shtml



RECOMMENDATIONS FOR PARENTAL EDUCATION

- Establish a plan to educate parents prior to screening.
- Education should include informing the parent or guardian that:
 - ◆ the purpose of the screening program is to screen for serious heart problems in babies.
 - ◆ the baby will be screened after he or she is at least 24 hours old.
 - ◆ the pulse ox test will be done on the baby's foot and/or right hand.
 - ◆ the pulse ox test is not painful and that it only takes a few minutes when the baby is quiet, warm and not moving.
 - ◆ it is possible that a baby with a heart problem may have a normal pulse ox reading.
 - ◆ they may ask questions at any time before, during, or following the screening.



PARENT PAMPHLET

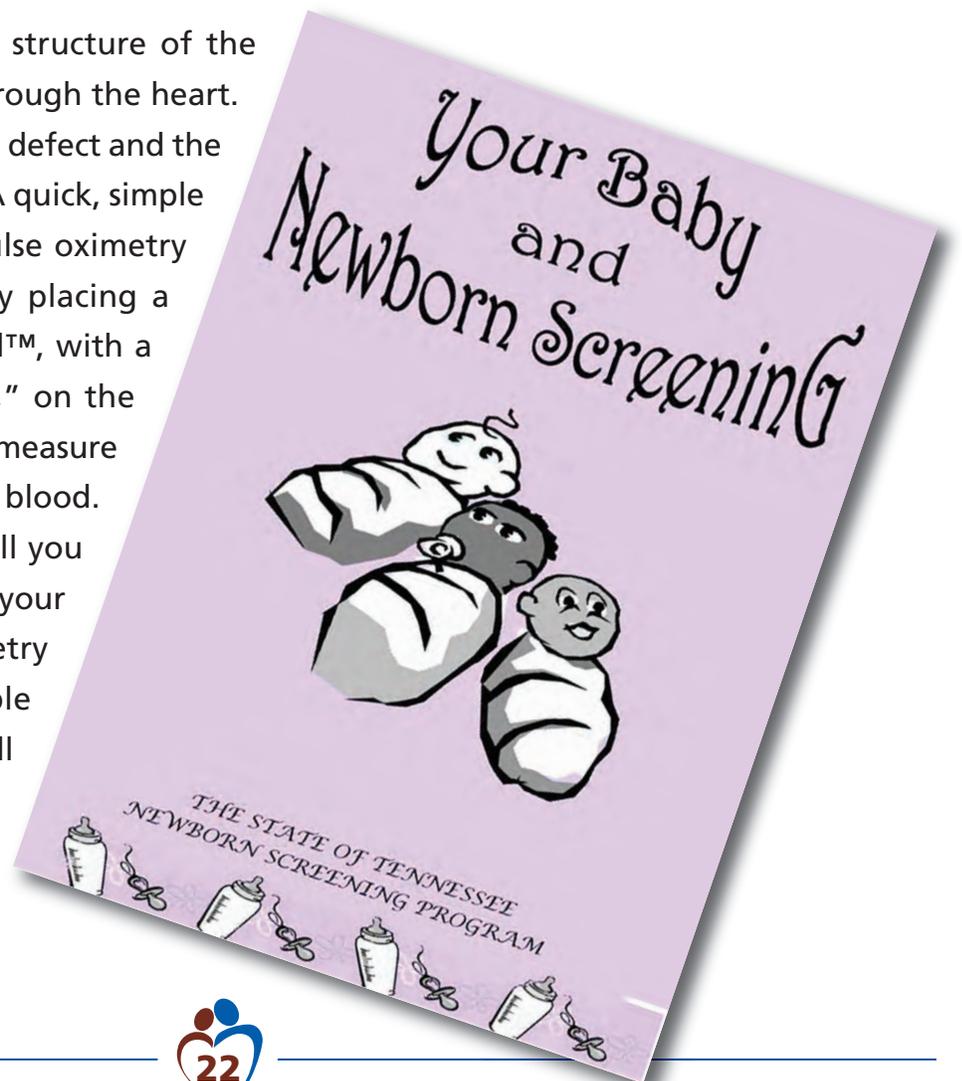
Tennessee Rules and Regulations 1200-15-1-.03 requires the distribution of a pamphlet to every parent, guardian or custodian of an infant screened. The pamphlet, distributed by the Department of Health, educates and prepares the family for newborn testing on their infant. Testing includes blood testing for metabolic disorders, screening for hearing loss and pulse oximetry screening for critical congenital heart disease.

Please contact the newborn screening program to order pamphlets (615) 532-8462. Pamphlets are also available at: <http://health.state.tn.us/NBS/index.htm>

Information in the parent pamphlet for critical congenital heart disease:

What is Critical Congenital Heart Disease (CCHD) Screening?

CCHD is a problem in the structure of the heart or the blood flow through the heart. It is the most common birth defect and the cause is not really known. A quick, simple and painless test called pulse oximetry (ox-ehmah-tree) is used by placing a sticky strip, like a band-aid™, with a small red light, or “probe,” on the baby’s foot and/or hand to measure how much oxygen is in the blood. The doctor or nurse will tell you what a normal range is for your child. If the pulse oximetry reading is low it is possible that your baby’s doctor will order additional tests.



FREQUENTLY ASKED QUESTIONS FOR PATIENTS AND FAMILIES

- **What is pulse oximetry?**

Pulse oximetry (ox-eh-mah-tree) is a simple and painless test that measures how much oxygen is in the blood. Another term for pulse oximetry is “pulse ox.”

- **How is pulse ox performed?**

The pulse ox is placed by a sticky strip, like a band-aid™, with a small red light, or “probe,” on the baby’s foot and/or hand. The probe is attached to a wire, which is attached to a special monitor that shows the pulse ox reading. The pulse ox test takes just a few minutes to perform when a baby is still, quiet, and warm. If a baby is crying, squirming, or cold it may take longer or not be possible. You can help comfort your baby and keep him or her warm, calm, and quiet while the test is being performed.

- **Why is pulse oximetry used?**

Pulse ox is used to measure how much oxygen is in the blood. Pulse ox is routinely used and can be used to monitor an infant’s oxygen level during a procedure or treatment. It can also be helpful in determining if an infant’s heart and lungs are healthy.

Pulse ox can also help to identify babies with low levels of oxygen in their blood that may have serious heart problems. A doctor or nurse practitioner may ask for more testing such as an ultrasound of the heart, or echocardiogram (“echo”) when a low pulse ox reading is identified. The echo will screen for a serious problem in the structure of the heart or the blood flow through the heart. Pulse ox can identify a baby with serious CHD before he or she leaves the newborn nursery.

- **Can the pulse ox test hurt my child?**

The pulse ox test is quick, simple and painless. It usually does not hurt the child.

- **What is congenital heart disease (CHD)?**

CHD is a problem in the structure of the heart

or the blood flow through the heart. CHD is the most common birth defect and the cause is not really known.

- **When will the pulse ox test be performed?**

The pulse ox test will be done after the baby is 24 hours old.

- **What is a normal reading?**

Pulse ox readings in the hand and foot that are 95 to 100 percent and equal to or less than 3% different from than each other are normal in healthy children. Children with heart or lung problems may have lower readings. A low pulse oximetry reading can be normal in newborns whose lungs and heart are adjusting after birth. If your child has a problem with his or her heart or lungs, your doctor or nurse will tell you what a normal pulse ox range is for your child. It is possible that your baby’s doctor will order additional tests.

- **Can a baby with serious CHD have a normal pulse ox reading?**

It is possible that the pulse ox test will not detect all forms of problems in the baby’s heart. Your baby should continue to have normal visits with his or her primary care doctor. If a problem with the heart is suspected, your primary care doctor will advise you.

- **What if I have questions or do not want to have my baby screened for serious heart problems?**

If you have questions about pulse ox or CHD, you should ask the doctor or nurse practitioner that is providing your prenatal care or the doctor or nurse caring for your baby after he or she is born. If you do not want your baby screened for serious heart problems you should tell your doctor or nurse when you are in the hospital to deliver your baby.

PREGUNTAS MÁS FRECUENTES?

• ¿Qué es la oximetría de pulso?

La oximetría de pulso es una prueba simple y no dolorosa que mide cuanto oxígeno existe en la sangre. También conocido como “pulse ox” en inglés.

• ¿Cómo e mide la oximetría de pulso?

Se coloca el oxímetro de pulso con una cita adhesiva, cómo una Band-aid™, con una luz roja pequeña o “sonda” en la mano o en el pie del bebé. La sonda se coloca a un alambre, el cual está conectado a un monitor especial que muestra la medición de la oximetría de pulso. La prueba de la oximetría de pulso toma sólo unos minutos para realizarse cuando el bebé está tranquilo, callado y tibio. Si el bebé está llorando, retorciéndose o frío puede tardar más tiempo o no sea posible hacerlo. Usted puede ayudar a consolar a su bebé y mantenerlo tibio, calmado y callado mientras se le realiza la prueba.

• ¿Por qué se usa la oximetría de pulso?

La oximetría de pulso se usa para medir cuánto oxígeno existe en la sangre. La oximetría de pulso es una prueba rutinaria y se usa para monitorizar el nivel de oxígeno del infante durante un procedimiento o tratamiento.

También puede servir para determinar si el corazón y los pulmones del infante están sanos. La oximetría de pulso también puede ayudar a identificar a los bebés que tengan bajos niveles de oxígeno en la sangre que puedan tener graves problemas cardiacos. Un médico o enfermero/a practicante puede pedir más pruebas como ultrasonidos del corazón o ecocardiograma (o eco) cuando se identifique una medida baja de la oximetría de pulso. El eco revisaría serios problemas de la estructura del corazón o el flujo de sangre en el corazón. El oxímetro de pulso puede identificar a un bebé con una seria ECC antes de retirarse de la unidad neonatal.

• ¿Le puede lastimar a mi hijo la prueba de la oximetría de pulso?

La prueba de oximetría de pulso no es invasiva y no es dolorosa. Normalmente no le causa dolor a su hijo.

• ¿Qué es enfermedad cardiaca congénita (ECC)?

La ECC es un problema en la estructura del corazón o con el flujo de la sangre en el

corazón. La ECC es el más común defecto congénito y se desconoce la causa.

• ¿Cuándo se le realizaría la oximetría de pulso?

La prueba de oximetría de pulso se realizará después de que nazca el bebé cuando tenga o sea mayor de 24 horas de nacido.

• ¿Cual es la medida normal?

La medida de la oximetría de pulso en la mano o en el pie que es de 95 a 100 por ciento e igual o menos que el 3% diferente de cada uno es normal en los niños sanos. Los niños con problemas cardiacos o pulmonares pueden tener medidas más bajas. Una medida de oximetría de pulso baja puede ser normal en los recién nacidos el cual los pulmones y el corazón se están ajustando después de haber nacido. Si su hijo tiene problemas con el corazón o con los pulmones, su médico o enfermero/a le dirá cual es la escala de oximetría de pulso normal para su hijo. Es posible que el médico de su bebé ordene pruebas adicionales.

• ¿Un bebé con un grave ECC puede tener una medida de oximetría de pulso normal?

Es posible que la prueba de oximetría de pulso no pueda detectar todas las formas de problemas del corazón del bebé. Su bebé debe continuar con las citas regulares con su doctor primario. Si se sospecha un problema con el corazón, su doctor primario le aconsejará.

• ¿Qué tal si tengo preguntas o no quiero que mi bebé se someta a alguna revisión para detectar graves problemas cardiacos?

Si tiene preguntas acerca de la oximetría de pulso o ECC, usted le debe preguntar al médico o al/la enfermero/a practicante que le proporciona la atención prenatal o el médico o personal de enfermería que atenderá a su bebé después de que nazca. Si no quiere que su bebé se someta a una revisión para detectar graves problemas cardiacos, usted debe decirle a su médico o al personal de enfermería cuando esté en el hospital para dar a luz.

• ¿Qué tal si tengo preguntas?

Si tiene preguntas acerca de la oximetría de pulso, usted debe preguntarle al médico o al personal de enfermería atendiendo a su bebé.

SECTION 5 / Resources

- *Children's National Medical Center
"Heart Smart" Video Series*
- *CDC - Pulse Ox Screening
for CCHD*



Children's National Medical Center in Washington, D.C. has developed the "Heart Smart" video series (created in collaboration with Genetic Alliance and filmed at Holy Cross Hospital). The series includes two educational videos, one targeted to providers and one to families. The videos are currently available on their website: <http://www.childrensnational.org/PulseOx/>



Pulse Oximetry Screening for Critical Congenital Heart Defects

- Babies with a critical congenital heart defect (CCHD) are at significant risk for death or disability if their condition is not diagnosed soon after birth.
- Pulse oximetry newborn screening can identify some infants with a CCHD before they show signs of the condition.
- Once identified, babies with a CCHD can be seen by cardiologists and can receive special care and treatment that can prevent death or disability early in life.
- Certain hospitals routinely screen all newborns using pulse oximetry screening. However, pulse oximetry screening is not currently included in most state newborn screening panels.

Understanding Critical Congenital Heart Defects

- **Congenital heart defects (CHDs) account for 24% of infant deaths due to birth defects.**
- **In the United States, about 4,800 (or 11.6 per 10,000) babies born every year have one of seven critical congenital heart defects (CCHDs, which also are known collectively in some instances as *critical congenital heart disease*).**
- **These seven CCHDs are:**
 - » **Hypoplastic left heart syndrome**
 - » **Pulmonary atresia (with intact septum)**
 - » **Tetralogy of Fallot**
 - » **Total anomalous pulmonary venous return**
 - » **Transposition of the great arteries**
 - » **Tricuspid atresia**
 - » **Truncus arteriosus**



Babies with one of these CCHDs are at significant risk for death or disability if their CCHD is not diagnosed and treated soon after birth. These seven CCHDs among some babies potentially can be detected using *pulse oximetry screening*, which is a test to determine the amount of oxygen in the blood and pulse rate. Other heart defects can be just as severe as these seven CCHDs and also require treatment soon after birth. However, pulse oximetry screening may not detect these heart defects as consistently as the seven disorders listed as CCHDs.

The Importance of Screening for Critical Congenital Heart Defects

Some babies born with a heart defect can appear healthy at first and can be sent home with their families before their heart defect is detected. It has been estimated that at least 280 infants with an unrecognized CCHD are discharged each year from newborn nurseries in the United States. These babies are at risk for having serious complications within the first few days or weeks of life and often require emergency care.

Pulse oximetry newborn screening can identify some infants with a CCHD before they show signs of a CCHD. Once identified, babies with a CCHD can be seen by cardiologists and can receive specialized care and treatment that could prevent death or disability early in life. Treatment can include medications and surgery.



National Center on Birth Defects and Developmental Disabilities
Division of Birth Defects and Developmental Disabilities



When and How Babies Are Screened

Pulse oximetry is a simple bedside test to determine the amount of oxygen in a baby's blood and the baby's pulse rate. Low levels of oxygen in the blood can be a sign of a CCHD. The test is done using a machine called a *pulse oximeter*, with sensors placed on the baby's skin. The test is painless and takes only a few minutes. Screening is done when a baby is 24 to 48 hours of age, or as late as possible if the baby is to be discharged from the hospital before he or she is 24 hours of age.



Pulse oximetry screening does not replace a complete history and physical examination, which sometimes can detect a CCHD before the development of low levels of oxygen in the blood. Pulse oximetry screening, therefore, should be used along with the physical examination.

Pulse Oximetry Screening Results

If the results are "negative" (in-range result), it means that the baby's test results did not show signs of a CCHD. This type of screening test does not detect all CCHDs, so it is possible to still have a CCHD or other congenital heart defect with a negative screening result. If the results are "positive" (out-of-range result), it means that the baby's test results showed low levels of oxygen in the blood, which can be a sign of a CCHD. This does not *always* mean that the baby has a CCHD. It just means that more testing is needed.

The baby's doctor might recommend that the infant get screened again or have more specific tests, like an *echocardiogram* (an ultrasound picture of the heart), to diagnose a CCHD. Babies who are found to have a CCHD also might be evaluated by a clinical geneticist. This could help identify genetic syndromes associated with CCHDs and inform families about future risks.



Centers for Disease Control and Prevention Activities

The Centers for Disease Control and Prevention (CDC) is part of the U.S. Department of Health and Human Services (HHS) Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC). SACHDNC was authorized by Congress to provide guidance to the HHS Secretary about which conditions should be included in newborn and childhood screening programs, as well as how systems should be developed to ensure that all newborns and children are screened and, when necessary, receive appropriate follow-up care. In September 2010, SACHDNC recommended that the HHS Secretary add pulse oximetry screening for CCHDs (i.e., the heart defects listed previously) to the Recommended Uniform Screening Panel. Some states currently are developing their own policies on pulse oximetry screening for CCHDs. As this screening is implemented, CDC will play an important role in the surveillance and tracking of babies with a CCHD found through pulse oximetry screening.

For more information on pulse oximetry screening for CCHDs, please visit
<http://www.cdc.gov/ncbddd/pediatricgenetics/CCHDscreening.html>

National Center on Birth Defects and Developmental Disabilities

For more information please contact the Centers for Disease Control and Prevention
1600 Clifton Road NE, Atlanta, GA 30333
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-63548
Email: cdcinfo@cdc.gov Web: www.cdc.gov

SECTION 6 / *References*

- *References*

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