Early Identification of Congenital Heart Defects with Pulse Oximetry Screening (POxS)

February, 2016
Objectives

- Recognize the importance of screening for Critical Congenital Heart Defects (CCHD) using pulse oximetry
- Apply the New Jersey recommended CCHD screening protocol
- Identify the role of the primary care physician in the detection of and referral of CCHD
Disclosure

The New Jersey Department of Health does not endorse or promote a specific brand or vendor for pulse oximetry supplies and equipment. Equipment and/or supplies presented in the education are for informational purposes only.
The Law

“The Commissioner of Health and Senior Services shall require each birthing facility licensed by the Department of Health and Senior Services to perform a pulse oximetry screening, a minimum of 24 hours after birth, on every newborn in its care.”

- NJ first state to implement a mandate for pulse oximetry screening
- Legislation signed into law June 2, 2011
- Implementation date August 31, 2011
- P.L. 2011, Chapter 74
Congenital Heart Defects

- 8-9/1,000 live births
- Minimum of 32,000-40,000 infants affected each year in US
- Approximately 25% of these are critical congenital heart defects (CCHD) or about 2 in 1,000 live births
Dylan’s Story

On September 1, a day after the law mandating inclusion of pulse oximetry testing on newborns became effective, a hospital pediatrician informed Lisa and Bill Gordon of Newton that the test performed on their baby was abnormal and he had a murmur.

Dylan was rushed to Morristown Medical Center, where it was determined he needed specialized pediatric cardiac heart surgery.

Dylan was transferred to Columbia University Medical Center, and several days later had the life-saving surgery correcting the abnormality discovered from the newly mandated newborn testing.

Rationale for Pulse Ox Screening

- An estimated 25-30% of newborns with CCHD could be missed at the time of hospital discharge (Mahle et al., 2009)
- About 1,200 more newborns with CCHD could be identified at birth hospitals using pulse oximetry (Peterson et al., 2013.)
- Approximately 200 newborns have died each year from missed CCHD and numerous others have significant morbidity from delayed diagnoses (Hokanson, 2010.)
  - Compare to an average 66 young athletes each year who die suddenly of undiagnosed cardiac defects (Maron et al. 2009)
Morbidity Due to Delayed Diagnosis

- Shock - global hypoxemic injury with multi-organ dysfunction
  - Hypotension
  - Poor ventricular function
  - Myocardial ischemia
  - Pulmonary hypertension
  - Renal dysfunction
  - Hepatic dysfunction
  - Decreased intestinal blood flow - NEC
  - DIC
  - Metabolic: hypoglycemia, hypocalcemia, myoglobinuria, hypoxic-ischemic encephalopathy

Mahle et al., 2009.
Detection of CCHD Continuum

- Prenatal Ultrasound
  - Typically provides a four-chamber view of the heart
  - Quality varies
  - Only half of all cases of CCHD are detected using this method
  - Less than 30% detection of lesions with two-ventricle anatomy
Detection of CCHD Continuum

- Physical Exam
  - Findings associated with CCHD may not be present before well baby discharge
  - Exam results vary depending on timing, setting and operator expertise
  - Low sensitivity (46%) but good specificity (99.8%)
  - Positive predictive value (PPV) around 60%
## Detection of CCHD

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
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<tr>
<td>Prenatal</td>
<td>60%</td>
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<tr>
<td>Clinical</td>
<td>20%</td>
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<tr>
<td>Pulse Ox</td>
<td>15.6%</td>
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<tr>
<td>Diagnostic Gap</td>
<td>4.4%</td>
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</table>

*Riede et al., 2010.*
Not As Pink As You Think...

- Some babies can initially appear healthy
  - Some babies do not have murmurs or cyanosis
  - Physical exam alone failed to identify half of CHDs that were not detected by a prenatal ultrasound
  - It’s estimated that 30% of infant deaths from CCHD occur prior to diagnosis
The Cyanotic “Blind Spot”

Hokanson, 2010.
CCHD Screening with Pulse Oximetry

- Indirectly monitors the oxygen saturation of a patient's blood and variations in blood flow in the skin
- Can detect mild hypoxemia without apparent cyanosis
- Can provide continuous and direct values
- Non-invasive
- Easy to use and widely available
- Cost-effective and extensively used

The Texas Pulse Oximetry Project, 2013.
Newborn Screening - New York – 1960’s

Robert Guthrie, MD

Virginia Apgar, MD

Source: Museum of Disability History

Screening Cost

- CDC Study in 7 NJ Birthing facilities
  - Mean screening time per newborn was 9.1 (standard deviation 3.4 minutes)
  - Hospitals’ total mean estimated cost per newborn screened was $14.19 (in 2011 U.S. dollars), consisting of $7.36 in labor costs and $6.83 in equipment and supply costs

Peterson et al., 2014.
These cost estimates exclude follow-up costs, such as further diagnostic testing, as well as administrative overhead costs.
Screening Case Discussion

- Brandon- TGA- failed screen; early detection
- HLHS- not screened; late detection
- Coarctation of aorta- passed screen (false negative); late detection
Case Presentation

- 39 weeks, NSVD, Apgar 9/9
- Discharged home on Day 2
  - Oximetry screening - post-ductal SpO2 100%
- Day 3
  - Lethargy
  - Decreased PO intake
  - Dry diapers
  - Tachypnea
  - Evaluated by pediatrician
Case Presentation

- Referral to ED for respiratory distress
  - grunting
  - retracting
  - unable to measure SpO2
- Intubated
- Umbilical arterial and venous catheters inserted
- ABG: 7.09/17/199/8/-23.3
- Chemistry: 143/8/104/6/63/5.98
- Echo: coarctation, ductus arteriosus closed
  - (history of normal fetal echo)
- Prostaglandin infusion
- Dialysis prior to repair of coarctation
CCHD Screening

■ Seven Primary Targets (17-31% of all CHDs):
  - Hypoplastic left heart syndrome
  - Pulmonary atresia (with intact ventricular septum)
  - Tetralogy of Fallot
  - Total anomalous pulmonary venous return
  - Transposition of the great arteries
  - Tricuspid atresia
  - Truncus arteriosus
CCHD Screening

Five Secondary Targets:

- Coarctation of the aorta
- Double outlet right ventricle
- Ebstein anomaly
- Interrupted aortic arch
- Single ventricle
Effect of CCHD on O2 Saturations

Modified diagrams courtesy of the Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities.
www.cdc.gov/ncbddd/heartdefects
Effect of CCHD on O2 Saturations

Tetrology of Fallot (TOF)

Hypoplastic Left Heart Syndrome (HLHS)

Modified diagrams courtesy of the Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities.

www.cdc.gov/ncbddd/heartdefects
Reliability of Pulse Ox Screening for CCHD

- Meta-analysis of 13 eligible studies with data for 229,421 newborn babies
  - Overall sensitivity of pulse oximetry for detection of critical congenital heart defects was 76.5% (95% CI 67.7 – 83.5)
  - Specificity was 99.9% (95% CI 99.7 – 99.9)
  - False-positive rate of 0.14% (95% CI 0.06 – 0.33)
  - Low false positive rate when pulse ox done after 24 hours from birth compared to before 24 hours

Thangaratinam et al., 2012.
CCHD Screening 2011

- Maryland Law Enacted
- Indiana Law Enacted
- New Jersey Law Enacted
- Law Implemented in New Jersey
- 1st Newborn screens positive after mandated screening
- CCHD added to the RUSP
- AAP Endorses POxS
- Kemper Pediatrics Paper

Timeline:
- May
- June
- August
- September
- November
- December

2011

New Jersey Critical Congenital Heart Defects Screening Program

American Academy of Pediatrics
New Jersey Chapter
New Jersey Critical Congenital Heart Defects Screening Program

AAP CCHD Screening Map: 2011 State Actions on CCHD

3 states enacted legislation

Legislation Introduced
Legislation Enacted
Executive Order
Regulatory/Guidance

American Academy of Pediatrics
DEDIcATED TO THE HEALTH OF ALL CHILDREN
New Jersey Chapter
AAP CCHD Screening Map: States’ Actions During 2011-2012 (As of December 17, 2012)
AAP CCHD Screening Map: States’ Actions During 2013 (As of December 23, 2013)
AAP CCHD Screening Map: States’ Actions During 2014 (As of January 29, 2015)
AAP CCHD Screening Map: State’s Actions (As of August 15, 2015)
Performing the Screen

- Best results when infant is at least 24 hours of age
- Use proper sensor for the device
- Conduct screening in quiet area and, if possible, with parent present to soothe and comfort the infant
- Conduct screening while infant awake and quiet
- Avoid screening when infant is crying, cold or in a deep sleep
Technical Factors

- False positive and negative readings
  - Poor perfusion
  - Motion artifact
  - Ambient light
  - Partial probe detachment
  - Differences between manufacturers

Reich et al., 2008.
Screening for Critical Congenital Heart Disease:
Recommendations from the New Jersey Department of Health and Senior Services

All babies 24-48 hours of age or shortly before discharge if < 24 hours*

Screen Right Hand (RH) and either Foot (F)

- <50% in RH or F
- 90% - < 95% in RH or F
  OR
  >3% difference between RH and F

Repeat screen in one hour (RH and either F)

- <50% in RH or F
- 90% - < 95% in RH or F
  OR
  >3% difference between RH and F

- >=95% in RH and F
  AND
  >=3% difference between RH and F

Repeat screen in one hour (RH and either F)

- <50% in RH or F
- 90% - < 95% in RH or F
  OR
  >3% difference between RH and F

- >=95% in RH and F
  AND
  >=3% difference between RH and F

Pass (Negative Screen)

Fail (Positive Screen)

- Notify responsible medical practitioner of positive screen and of need for further evaluation.
- Evaluate for other causes of low oxygen saturation (e.g., persistent pulmonary hypertension, pneumonia, infection...)
- In the absence of a clear cause of hypoxemia, perform a diagnostic echocardiogram by an expert in the interpretation of infant echocardiograms and review the report prior to discharge home. This might require transfer to another institution or use of telemedicine.

If saturation is <90% in either the hand or foot, the baby should have immediate clinical assessment and immediate referral to pediatric cardiology. In this case, do not wait and rescreen.

Pulse Oximetry Screening to Detect Critical Congenital Heart Disease

- Optimal results are obtained by using a motion-tolerant pulse oximeter that reports functional oxygen saturation, has been validated in low perfusion conditions, has been cleared by the FDA for use in newborns, and has a 2% root mean square accuracy.
- Document results in medical record.
- Screen in the right hand and one foot, either in parallel or direct sequence.
- Apply probe to lateral aspect of RH and F in areas that are clean and dry.
- The two sensors (light emitter and detector) should be placed directly opposite of each other.
- Administration of supplemental oxygen may alter the interpretation of the screening result. For infants requiring supplemental oxygen, delay this screening algorithm until infant is stable in room air. For infants being discharged home on supplemental oxygen, perform screen prior to discharge and review results with responsible medical practitioner.
- Symptomatic babies require clinical evaluation.
- This screening algorithm should not take the place of clinical judgment or customary clinical practice.

*Children in Special Care Nurseries (including Intermediate Care Nurseries, Neonatal Intensive Care Nurseries, etc...) should be screened at 24-48 hours of age or when medically appropriate after 24 hours of age. In all cases, screening should occur prior to discharge from the hospital.

Adapted from the Secretary’s Advisory Committee on Heritable Diseases in Newborns and Children (SACHDNC) Panel Workgroup’s Preliminary Recommendations, Jan. 2011.
*Connotes modification from SACHDNC’s algorithm based on recommendations by a NJDRHS expert panel to meet legislative requirements and improve sensitivity.
Screening Algorithm for Critical Congenital Heart Disease
Recommendations from the New Jersey Department of Health

All babies 24-48 hours of age or shortly before discharge if < 24 hours:

Perform and document pulse oximetry in both RIGHT HAND and either FOOT.

Is Pulse Oximetry reading < 90% in either the HAND or FOOT?

- YES
  - Are both HAND and FOOT 95-100%?
  - YES: Is the difference between the two measurements 3 or less?
    - YES: PASS
    - NO: FAIL

- NO: FAIL
  - Do not rescreen.

FAIL

Repeat the above pulse oximetry screening algorithm in one hour by obtaining new measurements from both right hand and either foot. If baby does not pass after a total of three screenings (initial screen and 2 repeat screens), notify responsible medical practitioner and follow recommendations in box below.

- Notify responsible medical practitioner of the failed screen and of need for further evaluation.
- Evaluate for other causes of low oxygen saturation (e.g., persistent pulmonary hypertension, pneumonia, infection, etc.).
- In the absence of a clear cause of hypoxemia, obtain a diagnostic echocardiogram by an expert in the interpretation of infant echocardiograms and review the report prior to discharge home. This may require transfer to another institution or a telemedicine consult.
- If saturation is < 90% in either the hand or foot, the baby should have immediate clinical assessment and immediate referral to pediatric cardiology. In this case, do not wait and rescreen.

- A pass on the screen 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.

- Optimal results are obtained by using a motion-tolerant pulse oximeter that reports functional oxygen saturation, has been validated in low perfusion conditions, has been cleared by the FDA for use in newborns, and has a 2% root mean square accuracy.
- Document results in medical record.
- Screen in the right hand and one foot, either in parallel or direct sequence.
- Apply probe to lateral aspect of right hand and foot in areas that are clean and dry. Use the two sensors (light emitter and detector) should be placed directly opposite of each other.
- Administration of supplemental oxygen may alter the interpretation of the screening result. For infants requiring supplemental oxygen, delay this screening algorithm until infant is stable in room air. For infants being discharged home on supplemental oxygen, perform screen prior to discharge and review results with responsible medical practitioners.
- Symptomatic babies require clinical evaluation.
- This screening algorithm should not take the place of clinical judgment or customary clinical practice.

In the NICU, screening should be performed at 24-48 hours of age or as soon as medically appropriate after 24 hours of age. Screening must be performed prior to transfer out of the hospital at ±24 hours of age. In all cases, screening should be performed prior to discharge to home.

Adapted from the Secretary’s Advisory Committee on Heart Defects in Newborns and Children (SACHDC)’s Expert Panel Working Group’s Preliminary Recommendations, Jan. 2011.
Screening Algorithm for Critical Congenital Heart Disease
Recommendations from the New Jersey Department of Health

All babies 24-48 hours of age or shortly before discharge if < 24 hours*

Perform and document pulse oximetry in both RIGHT HAND and either FOOT.

Is Pulse Oximetry reading < 90% in either the HAND or FOOT?

- NO
- YES

Are both HAND and FOOT 95-100%?
  - NO
  - YES

Is the difference between the two measurements 3 or less?
  - NO
  - YES

FAIL
Do not rescreen.

FAIL
Repeat the above pulse oximetry screening algorithm in one hour by obtaining new measurements from both right hand and either foot. If baby does not pass after a total of three screenings (initial screen and 2 repeat screens), notify responsible medical practitioner and follow recommendations in box below.
NJ Recommended Algorithm: Abridged Version

**PASS**
95%-100% in both extremities AND a difference of 3% or less between the readings.

**RESCREEN IN 1 HOUR**
90%-94% in either extremity OR a difference of 4% or more between the readings. Rescreen the infant up to 2 times, for a total of 3 screens.

**FAIL**
90%-94% in either extremity OR a difference of 4% or more between the readings after three screens.

**IMMEDIATE FAIL**
A reading of 89% or less in either extremity.
Evaluation for Failed Screen

- Clinical assessment
- Exclude infectious or pulmonary pathology
- Complete echocardiogram
- Pediatric cardiology referral as specified
Managing the Failed Screen

- Unless a non-cardiac cause can be identified for a failed screen, an infant who fails the screen should have a diagnostic echocardiogram done before being discharged.

- This could involve an echocardiogram within the hospital or birthing center, transport to another institution for the procedure, or the use of telemedicine for remote evaluation.
Most Heart Murmurs Are Not Pathological

- If heard in first 24 hours of life there is a 1 in 12 risk of congenital heart defect
- At six months: 1 in 7 risk
- At 12 months: 1 in 50 risk
- If detected at birth and still present at 12 months: 3 in 5 risk

Keane, Nadas' Pediatric Cardiology, 2nd ed.
Parent Education

Newborn Screening For Congenital Heart Defects

Information for Parents

A Lifesaving Law

NJ was one of the first states in the country to pass a law that all newborns need to have a screening test for Congenital Heart Defects (CHDs). Your baby will be tested for certain types of heart defects before leaving the hospital.

What are Congenital Heart Defects?

Congenital Heart Defects (CHDs) are problems with the way the heart formed or the way blood flows through the heart. Some CHDs can make a baby sick soon after birth. It is important that babies are tested for these heart defects before going home from the hospital.

How is the CHD screening test done?

The CHD screening test uses pulse oximetry or pulse ox for short. Pulse ox is a way to check the amount of oxygen in the baby's blood. This quick and simple test is done with a machine called a pulse oximeter. A sensor with a small light is placed on the baby’s hand and foot and is attached to the pulse oximeter to check the baby's oxygen level. Low oxygen in the blood can be a sign of a CHD.

Test results:

Sometimes a healthy newborn may have a low pulse or reading. A low pulse or reading could also mean there is a heart or breathing problem. If your baby’s CHD screening test shows low oxygen levels in the blood, more tests may be needed to find out the cause.

Importance of Regular Check-Ups:

It is important to bring your baby to all regular check-up visits. The pulse ox test picks up many, but not all types of heart problems at birth. There is a chance that a baby may have a normal pulse ox test and still have a heart defect. Babies who have heart problems may seem very sleepy, have a hard time eating, breathe fast, or look pale or bluish in color. Call your baby’s health care provider if you notice anything unusual about the way your baby looks or acts.

If you have any questions about CHD or pulse oximetry, talk to your baby’s health care provider.

For more information about CHD screening contact:

NEW JERSEY DEPARTMENT OF HEALTH

Phone (609) 292-1000

Fax (609) 984-7485

www.njhealth.state.nj.us

More information on Congenital Heart Defects is available at

http://nj.gov/health/fhs/nbs/cchd_resources.shtml
Communication of Screening Results

- Include screening results in discharge summary
- Include in the hand-off report to the receiving hospital if infant was transferred
Medical Home Neighborhood: Community Resource Model

- Parenting Support
- Early Intervention
- Early Child Mental Health Services
- Early Care and Education
- Child Care Resource and Referral Agency

Primary Care Medical Home

- Preventive Care
- Acute Care
- Chronic Care
- Developmental Services
- Lactation Support
- Home-Visiting Network
- Developmental Services
First Office Visit

- Pediatrician should have access to all screening results from hospital (Metabolic, CCHD, Hearing)

- This should be a “clean hand-off” between the hospital and pediatrician

- If patient not appropriately screened at birth facility, develop strategies for screening and evaluation
If Your Patient Failed CCHD Screening

- Confirm that the infant had a diagnostic echocardiogram
  - Make sure that the patient receives appropriate follow-up, such as being seen by a cardiologist
  - Facilitate long-term follow-up for patients diagnosed with CCHDs
One Week Check-Up

- Passing the newborn pulse ox screening DOES NOT rule out all important congenital heart defects
- It is crucial to note that the one-week-old infant in a pediatric office may have severe heart defects
Signs & Symptoms of CHD

- Cyanosis
- Tachypnea (often with diaphoresis during feeding)
- Poor perfusion & pulses (femoral)
- Murmur (not as pertinent)
- Poor weight gain (if infant is thriving, heart failure is very unlikely)
When is it an Emergency?

- Cyanosis: **YES**
  - Important to be sure it is not just acrocyanosis
- Poor perfusion & pulses: **YES**
- Tachypnea: Probable
- Murmur: Not in absence of all of the above
Findings at One Week Check-Up

- In the first week of life, concern for cardiac disease (tachypnea, cyanosis, poor pulses) requires immediate evaluation due to the potential for a duct-dependent lesion.
- If you are ever unsure, CALL!
### When Is Cardiology Referral Needed?

<table>
<thead>
<tr>
<th>Case</th>
<th>Murmur</th>
<th>Tachypnea</th>
<th>Poor wt. gain</th>
<th>Cyanosis (sat &lt;94%)</th>
<th>Decreased femoral pulses</th>
<th>What to do</th>
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<td>Could be heart or lungs</td>
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New Jersey Pulse Ox Screening Experience
New Jersey POxS Experience

Data Reporting

- Birthing facilities are required to report all failed POxS to the NJ Birth Defects Registry (BDR)
- Health care professionals are required to report infants with CCHD (and other congenital defects) who are New Jersey residents to the BDR
- Pulse ox core team and BDR staff investigate all POxS fails and registered cases of CCHD
- Vital Information Platform (VIP) electronic birth record includes prenatal CCHD detection and POxS data
Results of NJ Screening (Aggregate Reporting)

August 31, 2011 - December 31, 2014

Number of live-births: 338,124
Number of live-births eligible to be screened: 328,591
Number of live-births screened: 327,447
Proportion of eligible live-births screened: 99.7%

*Excludes expirations, <24 hours or not medically appropriate at end of period.
** VIP individual infant reporting replaced aggregate in 2015.
Failed Screens Registered to NJBDR: August 31, 2011- December 31, 2015

Total fails N= 266

Diagnostic evaluation attributable to POxS

No (One of 3 criteria) N= 146

Yes (None of 3 criteria) N= 120

One of 3 Criteria
- Prenatal diagnosis of CCHD
- Signs/symptoms at the time of the screen
- Cardiac consult or echocardiogram planned prior to the screen
Failed Screens Registered to NJBDR

- Diagnostic evaluation attributable to POxS (n=120)
  - 20 - CCHD
  - 16 - CHD
  - 10 - Significant non-cardiac conditions
  - 33 - PDA or PFO as only finding
  - 41 – No documented reason for failed POxS
    - 27 (66%) did not follow protocol
20 Infants with CCHD Were Detected

- Coarctation of the aorta (7)
- Ebstein anomaly (1)
- d-Transposition of the great arteries (1)
- Tricuspid atresia (1)
- Total anomalous pulmonary venous return (8)
- d-TGA and double outlet right ventricle (2)
### Characteristics of Failed Screens: CCHD

<table>
<thead>
<tr>
<th>CASE</th>
<th>AGE AT SCREEN</th>
<th>PRE-DUCTAL (final)</th>
<th>POST-DUCTAL (final)</th>
<th># OF SCREENS</th>
<th>FOLLOWED NJ PROTOCOL</th>
<th>FAILED ON NATIONAL PROTOCOL</th>
<th>FINAL DIAGNOSIS</th>
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<tr>
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<td>EBSTEIN ANOMALY Passed national protocol</td>
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</tbody>
</table>
Other Conditions Detected

- **16 CHDs:**
  - Atrial septal aneurysm
  - ASD
  - VSD
  - Pulmonary artery/pulmonary artery branch stenosis

- **10 Other significant non-CHD medical conditions:**
  - Sepsis
  - Pneumonia
  - Persistent pulmonary hypertension
  - Pulmonary bulla
Screening Success in New Jersey

- Since implementation through December 2014, 99.7% of eligible infants were screened.
- Through December 2015, POxS led to the detection of:
  - 20 infants with critical congenital heart defects (CCHD)
  - 16 infants with other congenital heart disease (CHD)
  - 10 infants with serious non-cardiac conditions
# Acknowledgements

## CCHD Screening Working Group Physician Education Committee

- **Terry Anderson, MD** – Children’s Hospital of Philadelphia  
- **Jeanne Craft, MD, FAAP** – St. Barnabas Medical Center  
- **Joseph Gaffney, MD** – Robert Wood Johnson University Hospital  
- **Leonard Goldsmith, DO** – Virtua Voorhees  
- **Susan Hudome, MD** – Monmouth Medical Center  
- **Robert Koppel, MD** – Cohen Children's Medical Center of New York  
- **Diane McClure, RN, DNP, CPNP, CCRN, AHN-BC** – St. Joseph’s Healthcare  
- **Puthenmadam Radhakrishnan, MD, FAAP** – Capital Health Medical Center-Hopewell  
- **Johanna Vidal-Phelan, MD, FAAP** – Children’s Hospital of Philadelphia
# Acknowledgements

## Pulse Oximetry Core Team

<table>
<thead>
<tr>
<th>Organization</th>
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<tbody>
<tr>
<td><strong>New Jersey Department of Health</strong></td>
<td>Lori Garg, MD, MPH</td>
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<td></td>
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<td>Lindsay Caporrino, BS</td>
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CCHD Screening information:

New Jersey Department of Health
http://www.state.nj.us/health/fhs/nbs/cchd.shtml

American Academy of Pediatrics

New Jersey Chapter, American Academy of Pediatrics
Presentation References


