

# **Pulse Oximetry Screening for Critical Congenital Heart Disease in Rural Hospitals and Home Births**

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# Place of Birth and Response to Failed Pulse Oximetry Screening

Birth Place	Comprehensive Evaluation of Cyanosis Available	Highest Level Provider Available	Neonatal Echo	Adult Echo
Medical Mecca	Yes	Cardiologist Neonatologist	Yes	Yes
Regional Center	Yes	Neonatologist Pediatrician	Yes	Yes
Community Hospital	Yes	Pediatrician Family Physician	Variable	Yes
Critical Access Hospital	Variable	Family Physician	No	Variable
Home or Birth Center	No	Midwife Birth Attendant	No	No

# When CCHD is missed and the baby becomes ill, where do they go?

<b>Birth Place</b>	<b>NICU Level</b>	<b>Personnel available to evaluate and treat</b>	<b>Neonatal Echo</b>	<b>PGE1</b>
<b>Medical Mecca</b>	<b>III</b>	<b>Intensive Care, Pediatric Cardiology, and Pediatric Cardiac Surgical Teams</b>	<b>Yes</b>	<b>Yes</b>
<b>Regional Center</b>	<b>II or III</b>	<b>Neonatologist Pediatrician</b>	<b>Yes</b>	<b>Yes</b>
<b>Community Hospital</b>	<b>I or II</b>	<b>Pediatrician Family Physician ER Physician</b>	<b>Variable</b>	<b>Variable</b>
<b>Critical Access Hospital</b>	<b>I</b>	<b>Family Physician ER Physician</b>	<b>No</b>	<b>No</b>

**Pulse oximetry screening  
for CCHD is easiest to do  
in the places where it is  
needed the least.**

# Degree of Difficulty

- The available local resources at the site of delivery determine the response to failed oximetry.
- A state with a larger percentage of critical access and community hospitals and a higher home birth rate will face greater challenges.
- Wisconsin
  - Lots of little hospitals
  - Lots of home births

# Critical Access and Smaller Rural Hospitals

## Wisconsin Data

Approximately 100 Hospitals routinely deliver babies.

Same day neonatal echocardiography is available in less than half.

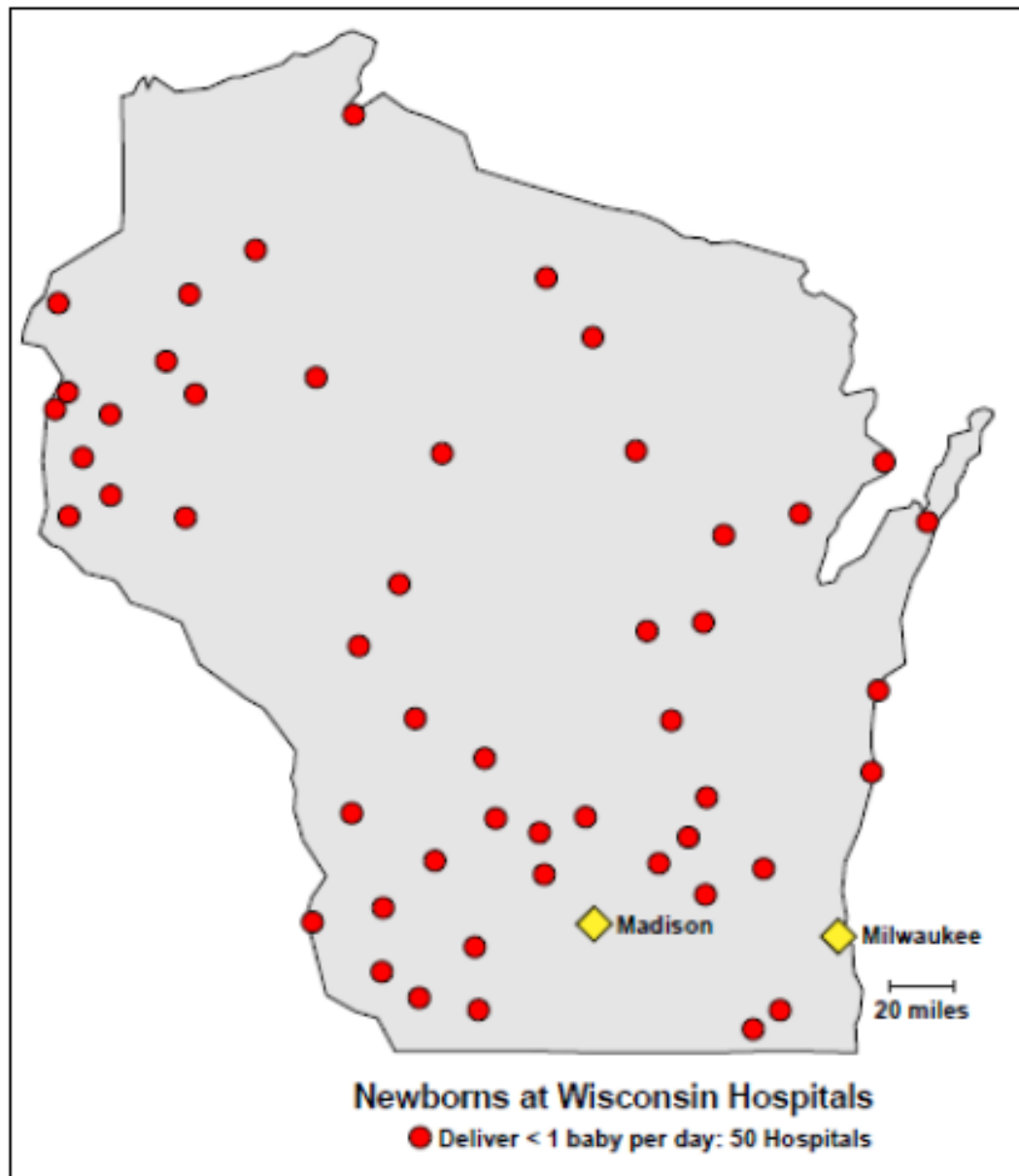
When echocardiography is not available, the average distance for transport to get an echo is 53 miles.

Half deliver less than one baby per day.

Supporting rarely used infrastructure is very challenging.

Beissel, Pulse Oximetry Screening For Congenital Heart Disease in Wisconsin. *Congenit Heart Dis.* 2011;6(5):521-522.

Peterson, Evaluating Newborns for CCHD: Expanding the Availability of Diagnostic Echocardiography, *Congenit Card Today* Nov 2013;11(11): 1-7

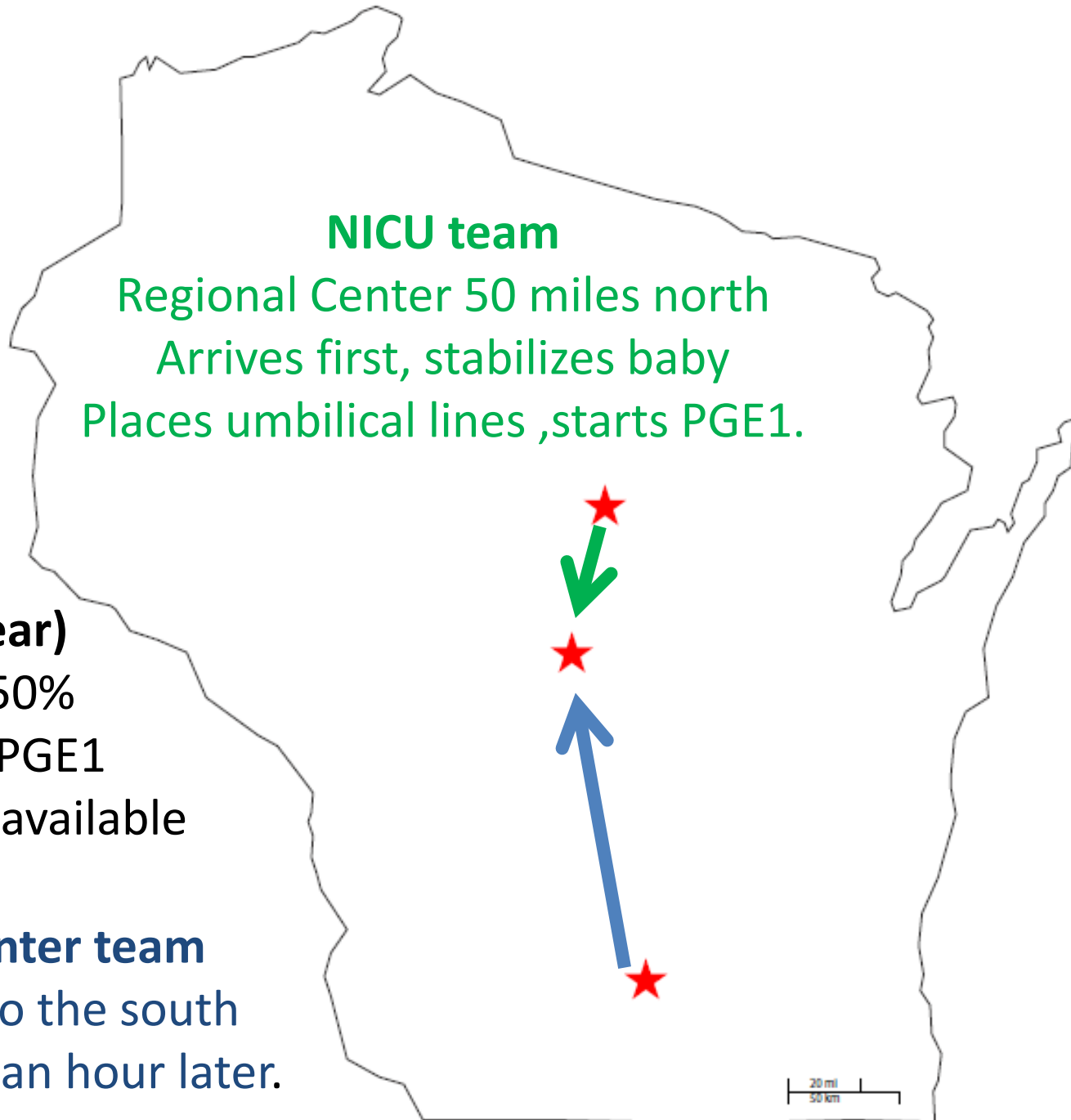


# Creative Solutions in Response to Failed Oximetry HLHS

**NICU team**  
Regional Center 50 miles north  
Arrives first, stabilizes baby  
Places umbilical lines ,starts PGE1.

**Community Hospital**  
(<500 deliveries per year)  
Right Hand 72%, Foot 50%  
No Neonatal Echo, No PGE1  
Only ground transport available

**Cardiac Center team**  
100 miles to the south  
Gets there an hour later.



# Painful False Positives

- **Critical Access Hospital**
  - (<200 deliveries per year)
  - **Adult, but not neonatal echocardiography available**
- Right Hand 88%, Foot 92% at 34 hours
- Transfer to NICU 75 miles away
- Saturations before transport team arrival
  - Right Hand 88-95%    Foot 92-99%
  - Always 4% or more difference
- Saturations normalize en route
- Normal echo, no evidence of other disease



# Newborn Echo Realities

- If you don't have a pediatric cardiac sonographer, the only people who *might* be willing to do neonatal echo are neonatologists and adult cardiac sonographers.
- If you have a neonatologist at your facility, you already have neonatal echocardiography.
- If your hospital relies on a mobile echo service, they might not be there when you need them.
- If your facility doesn't own an echo machine, it isn't going to buy one and create the infrastructure to perform same day neonatal echocardiography just for failed pulse oximetry.

# Using Adult Cardiac Sonographers

- Wisconsin Sonographers
  - **415 RDMS registered in adult echo**
  - 58 RDMS registered in pediatric echo
- Wisconsin Hospitals
  - 33/88 same day neonatal & adult echo
  - **43/88 same day adult, but not neonatal echo**
  - 12/88 no same day echo of any kind
- Beissel, Pulse Oximetry Screening For Congenital Heart Disease in Wisconsin. *Congenit Heart Dis.* 2011;6(5):521-522.
- Peterson, Evaluating Newborns for CCHD: Expanding the Availability of Diagnostic Echocardiography, *Congenit Card Today* Nov 2013;11(11): 1-7

# The Adult Cardiac Sonographer

- An adult cardiac sonographer can obtain the images needed to determine if a baby gets to go home or has to go to a medical mecca.
- Nearly all centers with same day adult echo already have the telemedicine capacity to send images to a pediatric cardiologist.
- Ideally, this remote relationship should begin long before the baby fails their screening.

# The Terrible Ten



- The Wisconsin SHINE Project developed an online course for those adult cardiac sonographers who might be called upon to perform neonatal echocardiography.
- 2 Free RDMS credits upon completion!
- An ongoing relationship between sonographer and cardiologist is a huge help.
- **<http://www.wisconsinshine.org/echo-training/>**

# **Pulse Oximetry Screening in Planned Home Births**

-where the needs and the  
challenges are the greatest

# Home Birth: Unique Challenges

- **0.7% of US births in 2009** <sup>1</sup>
  - 0.2% in Louisiana (120) and Washington DC (20)
  - 2% Wisconsin (*unofficial 2013 data*)
  - 2.6% Montana
- **>10x incidence of missed CCHD** <sup>2</sup>
  - Less use of prenatal ultrasound
  - Shorter post-delivery observation
  - Higher incidence of Ellis von Creveld in Amish communities
  - General reluctance to seek medical care
    - There may be no primary care physician

<sup>1</sup> NCHS Data Brief. January 2012 2012(84)

<sup>2</sup> Ng, Missed Congenital Heart Disease in Neonates, Congenit Heart Dis 2010;5(3):292-296.

# How many home births?

- Washington DC 20 per year
- Louisiana 120 per year
- Utah 800 per year
- Wisconsin 1300 per year
- Washington 1500 per year
- Texas 1600 per year
- Pennsylvania 2200 per year
- California 2600 per year

# Rural Home Birth

- If the baby has saturations of 88% and 89%, do you repeat the screening before referral?
  - What if the baby is 95% and 93% on the repeat?
- Where do you send them for evaluation?
  - Nearby critical access hospital
  - Not so nearby community hospital
  - Regional medical center
  - Distant medical mecca
- How will the hospital respond?





**Total WI Newborn Screening (NBS) Cards**  
 Jan-Nov 2013  
 60,437

**Total Hospital  
 NBS Cards**  
 59,241

**Out of Hospital  
 NBS Cards**  
 1,196

**Pass**  
 15,557

**Fail**  
 23

**Incomplete Data  
 or Not Screened**  
 43,661

**Oximetry Results  
 on NBS Card**  
 449

**No Oximetry Results  
 on NBS Card**  
 747

**Complete Data Set**  
 440

**Incomplete Data or  
 Not Screened**  
 9

**Appropriate Pass**  
 432

**Inappropriate Pass**  
 4

**Inappropriate Fail**  
 1

**Appropriate Fail**  
 3

**Second Measurement  
 Required to Pass: 4**

**Fail**  
 1

**Misinterpreted  
 Algorithm: 1**

**AV Canal with  
 Common Atrium: 1**

**False Negative  
 Coarctation with VSD: 1**

**Repeat Measurements  
 Not Performed: 3**

**Infection**  
 2

# Out of Hospital Births

- Small numbers, early learning curve, rolling enrollment of midwives, traditional birth attendants and public health nurses
- Failure Rates
  - Hospital births 0.14%
  - Out of Hospital Births 0.9%
- Definition of False Positives (3/440)
  - All had disease processes which affected care
    - AV Canal with hypoplastic RV, Sepsis, Sepsis
- One False Negative
  - Coarctation with VSD presenting at 4 months