



# Pulse Oximetry Screening for Critical Congenital Heart Disease After Planned Home Birth: Methods and Pilot Data

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## Background:

Pulse oximetry screening (POx) screening has become an accepted tool in the detection of critical congenital heart disease (CCHD) in neonates and all the available literature on POx screening comes from babies born in hospital. Previous data from Wisconsin suggests that the incidence of missed CCHD is significantly higher in babies born out of hospital (OOH). Possible explanations for the higher rate of CCHD in OOH births include a lesser utilization of prenatal ultrasound, a shorter window of observation by caregivers other than parents, and a higher incidence of CCHD in the home birth community, particularly in the plain clothes populations (Amish and Mennonite).

POx screening was recommended by the US Secretary of Health and Human Services in September 2011 and endorsed by the AAP in December 2011. The use of POx after planned home birth was recommended by the AAP in April 2013.

The Wisconsin SHINE Project was designed to provide information on POx, assist in the statewide implementation of POx, and assess the performance of the screening. A unique feature of the SHINE Project was the extension of POx screening into the OOH birth community. The SHINE Project is a collaborative effort between the University of Wisconsin, the Medical College of Wisconsin, the Wisconsin Guild of Midwives, the Wisconsin Department of Health Services, and the Wisconsin State Laboratory of Hygiene and is funded by one of the six demonstration grants from the Health Resources and Services Administration (a branch of the US Department of Health Services).

## Methods:

As part of the SHINE project, infrastructure was created to allow reporting of the results of POx screening (Pass/Fail/Not Screened) on the newborn screening blood card as is currently done with the newborn hearing screening.

For all hospital births, additional information on those babies who failed the POx screening or were found to have CCHD is collected. As the OOH birth community represents a unique and previously unstudied population, this extended data set was collected on all births. Performance of POx and reporting of this data to SHINE is voluntary and some mothers may choose not to have oximetry performed or the results shared with the SHINE Project.

The SHINE Project partnered with the Wisconsin Guild of Midwives to extend the use of pulse oximetry to the home birth community. Members of the Guild who were willing to participate in the SHINE project underwent training in the POx algorithm recommended by the AAP and in the use of the Masimo Rad5v oximeter. Training was performed by two Guild members with expertise in POx (GS, WMvR). Participating midwives were provided a Rad5v oximeter equipped with a reusable sensor and disposable probe wraps. Midwives also had round-the-clock access to SHINE personnel for technical and clinical support. A rolling enrollment of midwives began in January 2013.

The initial cohort was limited to members of the Wisconsin Guild of Midwives who are all licensed to practice in the state. The second phase of implementation has begun to extend the use of POx farther into the OOH birth community by training and enrolling traditional birth attendants and the public health nurses who primarily work within the plain clothes population.

## Results:

In the first 8 months of data collection, 29 midwives have completed training and reported on POx in their practices. Pulse oximetry results have been obtained on 304/838 OOH births in Wisconsin (36.3%). A complete data set has been collected on 286/304 (94.1%).

Of those with a complete dataset, 281 passed the screening and 5 failed. Of the 281 passing the screening, there has been one known false negative (coarctation with VSD, presenting clinically at four months). One baby was reported as having failed the screening due to a misinterpretation of the algorithm. There were four false positive results (AV canal with common atrium, sepsis x2, sepsis with possible inborn error of metabolism). The failure rate of 1.7% is higher than in most previously published studies.



CCHD was defined for the purposes of this project as one of the following 12 diagnoses:

1. Hypoplastic left heart syndrome
2. Pulmonary atresia
3. Tetralogy of Fallot
4. Total anomalous pulmonary venous return
5. Transposition of the great arteries
6. Tricuspid atresia
7. Truncus arteriosus
8. Coarctation of the aorta
9. Double outlet right ventricle
10. Ebstein's anomaly
11. Single ventricle + hypoplastic right heart syndrome
12. Interrupted aortic arch

## Discussion:

POx screening was rapidly accepted into clinical practice by the members of the Wisconsin Guild of Midwives and their patients with a high reporting rate. The complex POx algorithm was incorporated well, with only one infant misclassified as a failure. The screening failure rate in this very early data must be interpreted with caution due to the small numbers of patients. However, all of the four babies correctly identified as having failed their POx screening had disease processes which were identified more quickly because of POx detection of hypoxia. One of the limitations of this study is the possibility that false negative results could be missed. The relationship between midwife and mother is typically more personal than in the hospital birth community. Consequently, the possibility a midwife would not be aware of the late presentation of CCHD in one of their babies is likely to be lower than for a hospital birth provider.

## Conclusion:

POx screening can be effectively extended into the OOH birth community utilizing a partnership between the midwifery community, pediatric providers, and pediatric cardiologists. The failure rate may be higher than in the hospital birth community but further evaluation will be needed to confirm this finding. In this population one baby with a coarctation and VSD was missed and one baby with an atrioventricular canal and common atrium was identified. The next logical step is the extension of this technology into the population of greatest need, i.e. those plainclothes families using the services of traditional birth attendants or having unattended out of hospital deliveries.

