Voluntary Implementation of Critical Congenital Heart Disease Screening in Washington Hospitals

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KEY WORDS
heart defects, congenital/diagnosis; infant/newborn; neonatal screening; oximetry; Washington

ABBREVIATIONS
CCHD: critical congenital heart disease
REDCap: Research Electronic Data Capture
WADOH: Washington State Department of Health
www.hospitalpediatrics.org
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abstract

OBJECTIVES: To determine the extent of voluntary implementation of
pulse oximetry screening for critical congenital heart disease (CCHD) in
Washington. At the time of the study, there was no state legislative or regulatory
mandate for CCHD screening in Washington.

METHODS: A Web-based survey was sent to the nurse manager or nurse
educator of the well newborn unit at each of the 64 Washington hospitals
with active delivery services in May and June 2013. Telephone follow-up
was conducted for incomplete surveys. The survey assessed awareness and
implementation of the recommendation, the protocol followed, staffing and
equipment issues, pediatric cardiology support services, and the availability
of prostaglandin E1 at each birth hospital. A brief follow-up was performed in
December 2013 for hospitals not screening at the time of the initial survey.

RESULTS: As of December 2013, 89% of Washington birth hospitals
(accounting for 91.4% of births) had active CCHD screening programs.
The recommended protocol is used in 95% of screening hospitals. Screening
programs were instituted in 96% of hospitals using existing staff, but 52% of
hospitals purchased new durable equipment to institute screening.

CONCLUSIONS: There has been widespread voluntary adoption of pulse
oximetry screening for CCHD in Washington birth hospitals. Quality assurance
efforts are needed to assess the quality of the screening programs.

In September 2011, United States Health and Human Services Secretary Kathleen
Sebelius approved the addition of pulse oximetry screening for critical congenital
heart disease (CCHD) to the Recommended Uniform Screening Panel.1 Strategies
for implementing this recommendation were published 1 month later,2 with subsequent endorsement of CCHD screening by multiple professional and
advocacy groups, including the American Academy of Pediatrics, the American
Heart Association, the March of Dimes, and the American College of Cardiology.
New Jersey, the first state in the nation to implement CCHD screening, recently
reported that 99% of its newborns are being successfully screened.3 Older studies
demonstrated poor rates of voluntary screening either before (Wisconsin, 28% of
hospitals)4 or shortly after (Georgia, 31% of hospitals)5 the recommendation for
universal screening. To our knowledge, there are no recently published reports
describing the experience of a state in which adoption of CCHD screening has
been voluntary and initiated at the local level by hospitals and care providers.
Washington is 1 such state that at the time of the study had no legislative or
regulatory mandate for CCHD screening and, the Washington State Department
of Health (WADOH) had minimal involvement in the implementation of CCHD screening.

The objectives of the present study were as follows: (1) to determine the extent of voluntary implementation of CCHD screening in Washington; (2) to assess barriers to implementation of CCHD screening; and (3) to assess the protocols, staffing, and equipment used in hospitals that are actively screening.

**METHODS**

**Setting**

In 2011, Washington recorded 86,956 live births. Of these, 81,304 (93.5%) were born in hospitals and did not require admission to a NICU; these infants would thus have been eligible for CCHD screening (personal communication, WADOH, May 1, 2013). There were 2,680 (3%) out-of-hospital births, attended mostly by licensed midwives at home or in a birth center.

**Previous Educational Interventions**

Washington is served by 3 civilian pediatric cardiology groups located in the major cities of Seattle, Tacoma, and Spokane, as well as military pediatric cardiologists at Madigan Army Medical Center. Each of these groups provided information to at least some birth hospitals and providers in their catchment area about the new recommendation. In the case of our institution, a series of educational outreach efforts were undertaken, as shown in Fig 1. In addition, presentations about CCHD screening to individual practices or hospitals were provided upon request.

**Survey Design and Implementation**

A Web-based survey was developed by using Research Electronic Data Capture (REDCap), hosted at the University of Washington. REDCap is a secure, Web-based application designed to support data capture for research studies. Before survey distribution to the birth hospitals, the draft survey was reviewed by 4 nurses and physicians familiar with the content area or expert in survey design but who were not involved in the research; the survey was then revised to improve its clarity. In addition, multiple rounds of dummy data were entered into the REDCap tool to ensure that it was functioning properly.

A list of active delivery hospitals was obtained from WADOH, along with the numbers of births recorded at each hospital in 2011. The nurse manager or nurse educator for the well newborn unit for each hospital was identified, along with contact information, including e-mail addresses. An introductory e-mail containing a survey link was sent to each nurse manager or nurse educator, and a reminder e-mail was sent after 1 week to all nonresponders. One of the 3 authors contacted each nonresponder after 2 unanswered electronic attempts and completed the survey over the telephone. All surveys were completed between May 1, 2013, and June 28, 2013. The survey assessed awareness of the recommendation, status of implementation of the recommendation, the protocol followed, staffing and equipment issues, pediatric cardiology support services, and the availability of prostaglandin E₁ at each birth hospital. The full survey is shown in the Appendix. Not all questions were posed to all respondents, based on responses to previous questions. The article by Kemper et al was provided via hyperlink for review while answering the question about screening protocol used. For those who completed the survey by telephone, the protocol published in Kemper et al was described by the questioner.

After the initial survey, information about the recommendation and resources for screening implementation were provided to nurse managers who had...
been unaware of the recommendation. Additional contacts encouraging screening were made to the hospitals with no plans to screen by either WADOH or the Washington State Hospital Association.

A brief e-mail follow-up effort was made in December 2013 with the nurse managers at hospitals not actively screening at the time of the initial survey. The goal was to assess progress toward implementation of screening in the intervening 6 months.

Analysis

Descriptive statistics are presented. Data furnished by WADOH on numbers of births at each hospital in 2011 were used to translate hospital-level responses to estimates of availability of CCHD screening or other pediatric cardiology support services as a percentage of Washington in-hospital births. The study protocol was reviewed by the Seattle Children’s Hospital institutional review board and was determined to qualify as exempt research.

RESULTS

Sixty-four hospitals in Washington have active delivery services, none of which is at significant altitude. Responses were obtained from all 64 hospitals (100%). Status of implementation of CCHD screening is shown as the number of Washington delivery hospitals in Fig 2 and as a percentage of all Washington in-hospital births in Fig 3. At the time of the initial survey, 54 hospitals (84%), accounting for 90.0% of Washington in-hospital births, reported actively performing CCHD screening. Only 2 hospitals were unaware of the recommendation, and 1 hospital had decided against screening. As of December 2013, an additional 3 hospitals had begun universal screening, bringing the total to 57 (89%). Overall, 91.4% of Washington hospital births now occur at hospitals with active CCHD screening programs. Five hospitals were working on implementation of their policies, all with planned implementation dates in the first quarter of 2014. The hospital that had decided against screening had reversed this decision and was now planning to develop a screening protocol. The timing of implementation is shown in Fig 4. Three hospitals in the state had been routinely performing CCHD screening before the issuance of the national recommendation.

Of the 59 hospitals actively screening or in the process of developing a protocol at the time of the initial survey, 56 (95%) reported following or planning screening.
to follow the protocol published by Kemper et al. Two hospitals reported not following this protocol, and 1 was unsure.

Data about equipment and staffing issues from the 54 hospitals actively screening at the time of the initial survey are shown in Table 1. Most hospitals used registered nurses on staff to perform the screening process, and they reported that screening took between 5 and 10 minutes to perform. Only 1 hospital reported hiring additional staff to implement CCHD screening.

Data regarding the usual timing of discharge and screening are shown in Table 2. For an infant born after a term, vaginal delivery, the majority (87%) of screening hospitals reported a typical discharge time between 24 and 48 hours of age. No hospitals reported a routine length of stay >48 hours, but a minority (11%) reported a routine length of stay <24 hours. Usual age at screening paralleled the age at discharge, with 13% of hospitals routinely performing screening between 12 and 24 hours of life, an age which may be associated with a higher false-positive rate. For infants born by cesarean delivery, screening was most commonly (83%) performed between 24 and 48 hours of age, with screening after 48 hours of age the next most common scenario (9%). A variety of approaches was reported to address a situation in which a parent requested that a newborn be discharged before 12 hours of age; currently, there is little guidance in the literature for this scenario.

Consistent access to in-house pediatric echocardiography was reported by 52% of hospitals, accounting for 79.7% of Washington in-hospital births. Fifty-eight percent of hospitals (accounting for 74.6% of Washington in-hospital births) reported prostaglandin E₁ was available on their formulary. Twenty-five percent of nurse managers were unsure whether their pharmacy stocked prostaglandin E₁, whereas 17% reported it was not available on formulary.

**DISCUSSION**

This survey illustrates the widespread voluntary adoption of pulse oximetry screening for CCHD in Washington birth hospitals, in the absence of a state legislative or regulatory mandate. As of December 2013, 89% of Washington birth hospitals (accounting for 91.4% of births) had active CCHD screening programs. The birth hospitals not
currently screening have indicated their plans to begin screening soon.
Although some type of statewide requirement may be necessary to achieve and maintain universal screening, the majority of Washington newborns are currently benefiting from CCHD screening instituted by hospitals as a standard of care. Although 52% of well newborn units purchased new durable equipment to implement a screening program, the workload of screening has mainly been absorbed by existing staff, with only 1 hospital reporting hiring additional staff to implement CCHD screening. The vast majority of hospitals (95%) reported following the protocol published by Kemper et al.² Most hospitals (83%) performed screening in the recommended time interval.

With the challenge of implementation already accomplished by 89% of hospitals in our state, there is an ongoing need for assessment and monitoring of the quality of the screening program. Specifically, rates of screening, as well as false-positive and false-negative rates, need to be monitored, with appropriate quality improvement efforts instituted if the data indicate that the screening programs are performing suboptimally. This role is likely to be shared by private institutions and the WADOH. As our contribution to this effort, we have developed a Maintenance of Certification Part 4 project for physicians affiliated with our institution to receive credit for assessing and improving the quality of the CCHD screening program at regional birth hospitals.

One variable that reportedly affects the rate of false-positive screen results is the age at screening, with an estimated 10-fold increase when screening is performed before 24 hours of age.⁷ This factor is of interest in Washington, where early discharge of neonates is common. The American Academy of Pediatrics/American College of Obstetricians and Gynecologists’ Guidelines for Perinatal Care define a “shortened hospital stay” as <48 hours after delivery.⁸ Of note, none of the birth hospitals reported a typical length of stay for a term, vaginal delivery of >48 hours. Eleven percent of hospitals reported a usual length of stay for a term, vaginal delivery of <24 hours. We found that ~83% of hospitals reported most commonly performing screening at the recommended age (ie, between 24 and 48 hours), but a

FIGURE 4 Timing of implementation of CCHD screening by 56 of the 64 Washington birth hospitals. Bars indicate cumulative number of hospitals screening. The line indicates number of hospitals added in a given quarter (Q). Two hospitals did not provide a start date; data include 1 hospital that has partially implemented screening (third quarter of 2013). RUSP, Recommended Uniform Screening Panel.
TABLE 1 Equipment and Staff Information Reported by Nursing Leadership at 54 Birth Hospitals With Active CCHD Screening Programs at the Time of the Initial Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>No. of Hospitals</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did your unit purchase new oximeters expressly for the purpose of this screening program?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28</td>
<td>52</td>
</tr>
<tr>
<td>No</td>
<td>25</td>
<td>46</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>What type of probe is your unit using?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reusable</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>Disposable</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>Some of each</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>What brand(s) of oximeter is your unit using?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masimo (Irvine, CA)</td>
<td>26</td>
<td>48</td>
</tr>
<tr>
<td>Covidien (Dublin, Ireland)</td>
<td>28</td>
<td>52</td>
</tr>
<tr>
<td>Philips (Andover, MA)</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>None specified</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>&gt;1 brand (indicated above)</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Have you had to hire any additional staff to be able to institute pulse oximetry screening?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>No</td>
<td>52</td>
<td>96</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Who performs screening? Check all that apply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered nurse</td>
<td>50</td>
<td>93</td>
</tr>
<tr>
<td>Nursing assistant</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>Respiratory therapist</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Licensed practical nurse</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Physician or nurse practitioner</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Midwife</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>How long would you estimate it takes your staff to perform pulse oximetry screening?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 min</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>5–10 min</td>
<td>29</td>
<td>54</td>
</tr>
<tr>
<td>10–15 min</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>&gt;15 min</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Do not know</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

significant minority (13%) routinely performed screening before 24 hours of age. This factor will need to be monitored to determine its effect on false-positive rates.

Washington also has a high rate of out-of-hospital births (3.4% in 2012) compared with the US average of 1.4%. The rate of out-of-hospital births has increased over time in Washington (personal communication, WADOH, May 1, 2013). Birth center and home births are typically attended by licensed midwives or family practitioners in our state. Although out-of-hospital births were not addressed in the initial guidance on implementation of CCHD screening, the recent American Academy of Pediatrics’ position statement on planned home births affirmed that CCHD screening should be performed as a standard of care. Some practitioners performing home births conduct CCHD screening, but other research by our group indicates that implementation by licensed midwives is lagging behind hospital implementation and that the barriers to implementation are different from those encountered by hospitals (P.D. Evers, unpublished data, 2014).

In-house pediatric echocardiography is available to 79.7% of in-hospital births in Washington; it is mainly the hospitals with larger delivery volume that have this capability. Performance of a high-quality pediatric echocardiogram requires skill and ongoing practice, and it is thus expected that many of the smaller delivery hospitals do not offer this capability. However, the availability of prostaglandin E1 is surprisingly low (only 58% of nurse managers were confident that it was on formulary), given that initiation of prostaglandin can be a lifesaving stabilization measure. Hospitals should be encouraged to stock prostaglandin E1 as part of their institution of a CCHD screening program.

Our study used a survey technique and thus relied on nursing leadership to accurately report the status of screening for each newborn nursery (rather than collecting primary data on screening). This approach could limit the accuracy of the findings, particularly for questions such as the initiation date of screening, which is subject to recall. However, in the absence of any state-level monitoring of CCHD screening, a survey was the most practical way to assess screening practices throughout the state. As indicated earlier, our survey also provides limited insight into the quality of the screening programs that have been implemented individually by different hospitals. Although most hospitals are reportedly screening at the appropriate age and following the recommended protocol, this survey does not allow us to assess screening rates or false-positive or false-negative rates, which could vary significantly between hospitals. We believe that
the quality of our data is sufficient to achieve its primary objective: providing a baseline assessment of voluntary CCHD screening throughout the state. This information has allowed public health officials and other CCHD screening stakeholders in Washington to focus their efforts on encouraging and supporting implementation by the remaining hospitals and developing proposals for a statewide quality assurance/quality improvement structure for CCHD screening.

**CONCLUSIONS**

CCHD screening is now available to 91.4% of Washington neonates born in hospitals. This practice has been instituted as a standard of care by hospitals in the absence of a state legislative or regulatory mandate. Universal screening will require: (1) adoption of screening protocols by the remaining birth hospitals, which is likely to be achieved within the year; and (2) provision of screening for the relatively large out-of-hospital birth population in Washington. In addition, attention should be paid to quality assurance of CCHD screening, particularly in Washington, where early discharge of the newborn is common.

**ACKNOWLEDGMENTS**

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**REFERENCES**


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**TABLE 2 Information About Usual Timing of Discharge and Screening Reported By Nursing Leadership at 54 Birth Hospitals With Active CCHD Screening Programs at the Time of the Initial Survey**

<table>
<thead>
<tr>
<th>Question</th>
<th>No. of Hospitals</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the most common time frame to discharge a term newborn after an uncomplicated vaginal delivery?</td>
<td>12 to &lt;24 h</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>24 to &lt;48 h</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>≥48 h</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>1</td>
</tr>
<tr>
<td>What is the most common time frame to perform pulse oximetry screening for a term newborn after an uncomplicated vaginal delivery?</td>
<td>12 to &lt;24 h</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>24 to &lt;48 h</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>≥48 h</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>2</td>
</tr>
<tr>
<td>What is the most common time frame to perform pulse oximetry screening for a term newborn after an uncomplicated cesarean delivery?</td>
<td>12 to &lt;24 h</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>24 to &lt;48 h</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>≥48 h</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>2</td>
</tr>
<tr>
<td>If an infant is to be discharged before 12 h of life, how do you implement your screening protocol?</td>
<td>Do not screen</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Screen per usual protocol</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Begin screen; if first value is abnormal, delay discharge</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>We have not had any discharges at &lt;12 h</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>2</td>
</tr>
</tbody>
</table>
APPENDIX Full survey administered to nursing leadership of the 64 well newborn units in Washington hospitals. The survey assessed the implementation of pulse oximetry screening for critical congenital heart disease. Not all questions were posed to all respondents, depending upon answers to prior questions. LPN, licensed practice nurse; MD/ARNP, medical doctor/advanced registered nurse practitioner; NA, not applicable.

Pulse Oximetry Screening at Birth Hospitals in Washington

Please enter the name of the hospital where you work.

Are you familiar with current screening policies for WELL NEWBORNS at your hospital?

☐ Yes  ☐ No

In the fall of 2011, universal pulse oximetry screening of newborns for critical congenital heart disease was recommended for well newborns born in hospitals. Are you familiar with this recommendation?

☐ Yes  ☐ No

For all subsequent questions, “your unit” refers to the location of WELL NEWBORN care at the institution where you work.

Before the recommendation for pulse oximetry screening in the fall of 2011, did your unit perform routine pulse oximetry screening of newborns?

☐ Yes  ☐ No

Has your unit implemented pulse oximetry screening for critical congenital heart disease?

☐ Yes, we are currently screening
☐ We are in the process of developing/implementing a screening policy
☐ We plan to develop a policy but have not yet started to do so
☐ No; we have reviewed this topic and decided not to implement screening
☐ No; we have not made any decision on whether to implement screening

If your unit has decided not to implement screening, please indicate the most important reasons. Check all that apply.

☐ Our hospital does not perform pediatric echocardiograms
☐ Our providers do not think that unrecognized critical congenital heart disease is an important clinical problem
☐ Pulse oximetry screening is not reimbursed
☐ The false-positive rate is too high
☐ Other

If other, please explain further:
Please enter the screening start date or anticipated start date (month/year).

Is your unit following (or does it plan to follow) the protocol published by Kemper et al (Strategies for implementing screening for critical congenital heart disease. *Pediatrics*, 2011)? If you need to refer to the article, click here: www.pediatrics.org/cgi/content/full/128/5/e1259.

Has your unit had any abnormal screening results that resulted in identification of otherwise unsuspected critical congenital heart disease?

Has your unit had any abnormal screening results that resulted in identification of significant lung disease or other noncancer pathology?

Has your unit had any abnormal screening results that turned out to be false positives (otherwise healthy babies)?

What brand(s) of pulse oximeter is your unit using?

If other brand, please list here:

Did your unit purchase new oximeters expressly for this screening program?

What type of probe is your unit using? Check all that apply.

Are you familiar with the price your unit pays for disposable probes?

How much does your unit pay for a DISPOSABLE probe?

How long would you estimate it takes your staff to perform pulse oximetry screening?

Who is performing screening? Check all that apply.

Have you had to hire any additional staff to be able to institute pulse oximetry screening at your institution?

What is the most common time frame at your hospital to DISCHARGE a term newborn after an uncomplicated, VAGINAL delivery?

APPENDIX Continued.
What is the most common time frame at your hospital to PERFORM PULSE OXIMETRY SCREENING for a term newborn after an uncomplicated VAGINAL delivery?

☐ <12 hours of life
☐ 12 to <24 hours of life
☐ 24 to <48 hours of life
☐ ≥48 hours of life

If screening is not performed because the rate of false-positives is too high
☐ Screening is performed as close as possible to discharge per the usual protocol
☐ Screening is performed as close as possible to discharge. If the first value is abnormal, discharge is delayed. We wait until after 24 hours to obtain any further data.
☐ We have not had any infants discharged at <12 hours
☐ Other

If another approach to screening is taken at <12 hours, please explain here:

☐ We do nothing further
☐ We notify the primary care provider to screen the patient in the office
☐ We bring the infant back to a postdischarge clinic and perform screening between 24 and 48 hours of age
☐ Other

If other follow-up is arranged, please explain here:

What is the most common time frame at your hospital to PERFORM PULSE OXIMETRY SCREENING for a term newborn after an uncomplicated CESAREAN delivery

☐ <12 hours of life
☐ 12 to <24 hours of life
☐ 24 to <48 hours of life
☐ ≥48 hours of life
☐ NA; we do not perform cesarean deliveries at our hospital

Can you order an echocardiogram to be performed on a newborn at your hospital?

☐ Yes
☐ No
☐ Sometimes

Who interprets your pediatric echocardiograms? Check all that apply.

☐ Seattle Children’s Hospital main echo lab (Seattle)
☐ Seattle Children’s South Sound Cardiology Group (Trippel/Stephenson/Powers)
☐ Northwest Congenital Heart Care (Pediatrics/McClosey & colleagues)
☐ Madigan Army Medical Center Cardiologists
☐ Northwest Center for Congenital Heart Disease (Spokane/Garabedian & colleagues)
☐ Oregon Health & Sciences University/Doernbecher Children’s Hospital
☐ Pediatric Cardiology Center of Oregon (Legacy Emanuel, Portland, OR; Chang/King/Kaiser/LeGras)
☐ Do not know
☐ Other

If you do not have pediatric echocardiography available at your facility, where would you refer a newborn for further evaluation?

Is prostaglandin E1 available on your hospital’s formulary?

☐ Yes
☐ No
☐ Do not know

Thank you for completing the survey. Your participation is much appreciated. If you have any further questions about this survey, please contact Amy Schultz, MD at amy.schultz@seattlechildrens.org

APPENDIX Continued.