Published in final edited form as:

J Perinatol. 2023 April ; 43(4): 484–489. doi:10.1038/s41372-022-01512-4.

Levels of neonatal care among birth facilities in 20 states and other jurisdictions: CDC levels of care assessment tool℠ (CDC LOCATe℠)

Jennifer L. Wilkers[1,2,✉], **Carla L. DeSisto**[1], **Alexander C. Ewing**[1], **Sabrina A. Madni**[1,2], **Jennifer L. Beauregard**[1,3], **Mary D. Brantley**[1], **David A. Goodman**[1]

[1]Division of Reproductive Health, Centers for Disease Control and Prevention, Atlanta, GA, USA.

[2]Oak Ridge Institute for Science and Education, Oak Ridge, TN, USA.

[3]U.S. Public Health Service Commissioned Corps, Rockville, MD, USA.

Abstract

OBJECTIVE: Describe discrepancies between facilities' self-reported level of neonatal care and Centers for Disease Control and Prevention Levels of Care Assessment Tool℠ (CDC LOCATe℠)-assessed level.

STUDY DESIGN: CDC LOCATe℠ data from 765 health facilities in the United States, including 17 states, one territory, one large multi-state hospital system, and one perinatal region within a state, was collected between 2016 and 2021 for this cross-sectional analysis.

RESULT: Among 721 facilities that self-reported level of neonatal care, 33.1% had discrepancies between their self-reported level and their LOCATe℠-assessed level. Among facilities with discrepancies, 75.3% self-reported a higher level of neonatal care than their LOCATe℠-assessed level. The most common elements contributing to discrepancies were limited specialty and subspecialty staffing, such as neonatology or neonatal surgery.

CONCLUSION: Results highlight opportunities for jurisdictions to engage with facilities, health systems, and partners about levels of neonatal care, and to collaborate to promote standardized systems of risk-appropriate care.

✉**Correspondence** and requests for materials should be addressed to Jennifer L. Wilkers. qlk8@cdc.gov.

AUTHOR CONTRIBUTIONS

JW conceptualized and designed the work; acquired, analyzed, and interpreted the data; and drafted the manuscript. CD replicated the analysis and revised the manuscript critically for important intellectual content. AE and DG conceptualized and designed the work; acquired the data; and revised the manuscript critically for important intellectual content. SM, JB, and MB revised the manuscript critically for important intellectual content.

DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

COMPETING INTERESTS

The authors declare no competing interests.

INTRODUCTION

Risk-appropriate care, also known as perinatal regionalization, is a strategy developed to ensure pregnant persons and infants receive care at a birthing facility that has the full range of capabilities and staffing to appropriately meet the needs of patients [1]. The strategy of risk-appropriate care was initially proposed by the March of Dimes, in the 1976 report, Toward Improving the Outcome of Pregnancy (TIOP I) [2] and improved upon in later versions (TIOP II and TIOP III) [1, 3] in collaboration with clinical membership organizations, including the American Academy of Pediatrics (AAP). The TIOP I report included criteria that stratified maternal and neonatal care into three levels and recommended coordination of high-risk pregnant persons and infants to facilities based on the level of complexity of care provided [2].

A policy statement released by AAP in 2004 first defined levels of neonatal care, delineating facilities based on their capacity to provide basic care, specialty care, and subspecialty care for critically ill newborn infants [4]. Revised in 2012, AAP published a policy on levels of neonatal care outlining the minimum capabilities, functional criteria, and provider type for a facility to function at Levels I, II, III, or IV [5]. Level I facilities are considered well newborn nurseries, focusing on providing a basic level of care to infants who are considered low-risk and transferring those with higher risk to a facility capable of providing specialty neonatal care [5]. Level II, or specialty care facilities, have the capacity to care for infants who are moderately ill with problems expected to rapidly resolve [5]. Level III, or subspecialty neonatal intensive care units (NICU), are prepared to have continuously available personnel (neonatologists, neonatal nurses, respiratory therapists) and equipment to provide life support for as long as needed [5]. Level IV facilities, or regional NICUs, care for the most complex and critically ill infants through a full range of pediatric medical and surgical subspecialists continuously available 24 h a day [5]. The 2012 policy is included in the Guidelines for Perinatal Care, written by AAP, the American College of Obstetricians and Gynecologists (ACOG), and the Society for Maternal and Fetal Medicine (SMFM) [6]. The Guidelines for Perinatal Care focus on perinatal regionalization, patient safety, and quality improvement, and provide updated guidelines on maternal transport, immunizations, nutrition, planned home birth, and levels of neonatal care definitions [6]. Very low birth weight (VLBW) infants delivered in Level III and IV facilities have a decreased likelihood of neonatal or predischarge death [7, 8], providing strong evidence that levels of neonatal care are important for improving neonatal health outcomes.

Despite guidelines based on specified criteria, the implementation of risk-appropriate care policies continue to vary between states [9]. State-led improvements, such as health system reimbursement strategies, ongoing monitoring and reviews, and verification programs, can support consistency in oversight of neonatal services and implementation of risk-appropriate care [9, 10].

Federal, state, and local leaders representing public and private agencies engaged with the Collaborative Improvement and Innovation Network to Reduce Infant Mortality expressed the need for a standardized method to assess and improve the monitoring of levels of care among healthcare facilities [11]. A comprehensive understanding of facility providers,

capacity, and levels of care may allow state and jurisdiction health facilities and public health agencies to align systems of risk-appropriate care based on their specific state needs. To provide a comprehensive understanding of levels of care, the Centers for Disease Control and Prevention (CDC), along with AAP and ACOG/SMFM, developed the CDC Levels of Care Assessment Tool^{SM} (CDC LOCATe^{SM}) [11]. This web-based, standardized assessment aligns with the 2012 AAP policy statement and 2019 ACOG/SMFM levels of maternal care guidelines, including sections specific to both neonatal and maternal care capabilities of the responding facility [5, 6, 12].

Through the application of CDC LOCATe^{SM}, participating jurisdictions can review levels of care provided by each responding delivery facility and the distribution of staff and services (e.g., capabilities and equipment, such as congenital cardiac surgery and complex ventilation) throughout their state. Jurisdictions are provided with multiple resources, including a facility report template and presentation slide deck, as tools for states to clearly communicate assessment results. Findings from CDC LOCATe^{SM} are intended to foster facility- and state-level public health intervention strategies to support systems of risk-appropriate care and support clinical and public health understanding of perinatal systems of care [13]. Findings from the section on maternal care, including discrepancies between self-reported level of maternal care and CDC LOCATe^{SM}-assessed level of maternal care, were previously published [14]. This analysis describes the elements from the AAP levels of neonatal care policy contributing to variations between self-reported levels of neonatal care and CDC LOCATe^{SM}-assessed levels of neonatal care, including discrepancies in facility personnel and service availability.

METHODS

CDC LOCATe^{SM} data from 765 health facilities in the United States, including 17 states, one territory, one large multi-state hospital system, and one perinatal region within a state, were collected between 2016 and 2021 for this cross-sectional analysis. There was no overlap of jurisdictions in this analysis (i.e., no hospital would have reported under both a state and a perinatal region). Jurisdictions interested in applying CDC LOCATe^{SM} contacted the CDC's Division of Reproductive Health directly to begin the process. Within each jurisdiction, CDC LOCATe^{SM} is implemented by a lead agency, or champion, through a web-based tool like SurveyMonkey or REDCap. CDC does not initiate or collect data. Champions, such as hospital associations, state perinatal quality collaboratives, and state public health departments, have a preexisting relationship with local health facilities where births occur [11]. This champion communicates the purpose of CDC LOCATe^{SM} to all health facilities where births occur within their jurisdiction to ensure facilities are aware of the purpose and process of administering CDC LOCATe^{SM}. The CDC LOCATe^{SM} assessment is self-administered by each facility.

Health facilities may designate up to 10 respondents to assist in completing the assessment, allowing staff with the relevant knowledge to contribute information. Common respondents include medical directors, labor and delivery managers, nurse managers, and quality directors and specialists. To keep respondent burden to a minimum, the assessment focuses on collecting information necessary to distinguish between levels of care which includes

sections specific to both maternal and neonatal care capabilities of the responding health facility. The section on neonatal care includes 11 questions related to the availability of facility personnel and services that involve the care of newborns, including the availability of subspecialists, volume of services, receiving and emergency transports, facility-level statistics (e.g., live births and high-risk and convalescent transfers), and self-reported level of neonatal care [5]. Not all questions are used to assess the level of neonatal care, but are included for use by jurisdictions for further analyses. After a jurisdiction completes data collection through their preferred web-based tool, the champion exports their data and sends the de-identified file to CDC for processing. After processing, preliminary results are shared back with the jurisdiction champion to actively follow-up and confirm responses from facilities with inconsistent responses. The jurisdiction champion and CDC collaborate to finalize CDC LOCATe^{SM} results. Once finalized, CDC returns the data file and the final results for each jurisdiction to use and disseminate, as desired.

To produce a CDC LOCATe^{SM}-assessed level of neonatal care, CDC applies a standard algorithm to the responses to the questions directly related to personnel and service requirements for each level of neonatal care, as defined by the 2012 AAP levels of neonatal care policy statement (Table 1) [5, 6]. While some requirements are met through the availability of a single provider or service, other criteria may allow for several options (or a combination of options across multiple questions) to meet a specified level of neonatal care. Independent of the CDC LOCATe^{SM}-assessed level, the assessment asks facilities to self-report a level of neonatal care based on the 2012 AAP levels of neonatal care policy statement. Facility response options include “I, II, III, IV, Not sure”.

Jurisdictions included in this analysis implemented seven versions of CDC LOCATe^{SM}; each version was implemented with slight wording changes for respondent clarity (Table 2). Data across all versions were comparable and included in this analysis. Eight facilities were excluded from the analysis due to inconsistencies in data collection. Discrepancies between facilities’ CDC LOCATe^{SM}-assessed level of neonatal care and self-reported level of neonatal care were identified using the 2012 AAP levels of neonatal care policy defining level-specific requirements for personnel and services and described by percent agreement. Frequencies of personnel and service availability were calculated within each CDC LOCATe^{SM}-assessed level of neonatal care. All analyses used SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy (See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.). This activity was determined by CDC not to be human subjects research requiring IRB approval.

RESULTS

Analysis of CDC LOCATe^{SM} data from 765 health facilities found 326 facilities (42.6%) assessed as Level I, 325 (42.5%) as Level II, 95 (12.4%) as Level III, and 19 (2.5%) as Level IV (Table 3). Among these same facilities, 261 (34.1%) self-reported as a Level I, 270 (35.3%) as Level II, 141 (18.4%) as Level III, 49 (6.4%) as Level IV, and 44 (5.8%) did not self-report a level of neonatal care (Table 3). Among the 721 facilities with a self-reported level of neonatal care, 239 (33.1%) had a discrepancy between their

CDC LOCATe[SM]-assessed level of neonatal care and self-reported level. Among the 239 facilities with a discrepancy between their CDC LOCATe[SM]-assessed level of neonatal care and self-reported level of neonatal care, 180 (75.3%) self-reported a higher level of neonatal care than their CDC LOCATe[SM]-assessed level, and 59 (24.7%) self-reported a lower level of neonatal care than their CDC LOCATe[SM]-assessed level. Among the 180 facilities with a higher self-reported level of neonatal care when compared to their CDC LOCATe[SM]-assessed level, 12 facilities had a discrepancy of two or more levels. Among the 59 facilities with a lower self-reported level of neonatal care when compared to their CDC LOCATe[SM]-assessed level, all facilities had a discrepancy of only one level.

Reasons for discrepancy among facilities that self-reported a higher level of neonatal care than their CDC LOCATe[SM]-assessed level of neonatal care include a lack of personnel only (83.9%), a lack of services only (6.1%), or a lack of both personnel and services (10.0%) (Table 3). The element from the AAP levels of neonatal care policy contributing to discrepancies among CDC LOCATe[SM]-assessed Level I facilities that self-reported a higher level of neonatal care is the lack of a neonatologist on staff (97.6%); in other words, facilities that self-reported being a Level II or higher could not meet the requirements for that level because they did not have a neonatologist, leading them to CDC LOCATe[SM]-assess as Level I (Table 4). The element from the AAP levels of neonatal care policy contributing to discrepancies among CDC LOCATe[SM]-assessed Level II facilities that self-reported a higher level of neonatal care is the lack of at least one pediatric medical subspecialist or surgical subspecialist, regardless of availability: pediatric surgeon, pediatric anesthesiologist, and/or pediatric ophthalmologist (89.3%). The most common element from the AAP levels of neonatal care policy contributing to discrepancies among CDC LOCATe[SM]-assessed Level III facilities that self-reported at a higher level of neonatal care is the lack of appropriate availability for at least one pediatric medical subspecialist/surgical specialist: pediatric surgeon, pediatric anesthesiologist, and/or pediatric ophthalmologist (65.2%).

The provision of subspecialty care increased with the level of neonatal care (Table 5). Across all levels of neonatal care, the most common service is conventional mechanical and/or CPAP (65.9%) and the least common is congenital cardiac surgery (4.2%). The most common subspecialist across all levels of neonatal care is neonatologist (59.0%).

DISCUSSION

The CDC LOCATe[SM]-assessed level of neonatal care is based on the most recent AAP levels of neonatal care policy statement [5, 6], reflecting the minimal capabilities, provider type, and functional criteria required for each facility. In this analysis, 33.1% of facilities with a self-reported level of neonatal care had a discrepancy between their CDC LOCATe[SM]-assessed level of neonatal care and self-reported level. Facilities self-reporting a higher level of neonatal care than their CDC LOCATe[SM]-assessed level of neonatal care contributed to the majority of discrepancies (75.3%). The most common elements from the AAP levels of neonatal care policy missing among facilities with a discrepancy between their CDC LOCATe[SM]-assessed level of neonatal care and self-reported level included a reported lack of neonatologist, lack of at least one pediatric medical subspecialist/surgical

specialist, and lack of appropriate availability for at least one pediatric medical subspecialist/surgical specialist.

CDC LOCATe[SM] was not designed to be a tool for health care regulation or formal designation of levels of care. Many states have regulatory policies on levels of neonatal care designation, with varying levels of oversight required [10]. Some states allow facilities to self-designate their level of neonatal care, with or without a site visit from the designating authority for review [10]. During a site visit, designating authorities have the ability to observe the actual composition and functioning of the facility independently and objectively and collect verifiable data for continuous monitoring and oversight, which may also inform licensure [10]. State policies may include facility surveys or questionnaires, completed by clinicians at facilities, for use by the designating authority to determine levels of care [10]. Some states allow facilities to have their level of neonatal care designated through a state-approved organization, such as the AAP [15, 16]. A potential consequence of self-assessing at a level not reflective of the true availability of services and personnel may be that facilities treat or accept transfers of infants who require care beyond what the facility is able to provide. Implementing the 2012 AAP levels of neonatal care policy can help ensure health facilities will operate at the same standardized level of neonatal care, resulting in consistency in facility-level implementation [9].

Proportions of subspecialists and services available varied by CDC LOCATe[SM]-assessed level of neonatal care. This was an expected finding because the 2012 AAP levels of neonatal care policy statement does not require subspecialists or all services in the lower levels of neonatal care. Since the majority of facilities included in our analysis CDC LOCATe[SM]-assessed as a Level I and II (85.1%), we expected to see a higher proportion, for example, of neonatologists across levels (required for Levels II-IV) as compared to complex pediatric subspecialty surgery services (only required for Level IV). Notably, many lower-level facilities had some capabilities of higher level facilities; for example, 80.1% of facilities that CDC LOCATe[SM]-assessed as a Level I had conventional mechanical and/or continuous positive airway pressure (CPAP) and 22.2% of facilities that CDC LOCATe[SM]-assessed as a Level II had a pediatric surgeon. Although the majority of newborns do not require assistance to begin breathing at birth, approximately 10% will require some type of assistance [17]. Effective resuscitation, followed by effective stabilization, reduces neonatal morbidity and mortality [18], and all facilities Levels I-IV are required to provide neonatal resuscitation and stabilization at every delivery [5, 6]. While studies have examined neonatal provider availability, there are still gaps in how the availability of specific subspecialists and services may impact the morbidity and mortality of high-risk neonates [19–21]. Between 2014 and 2019, consistency increased in state policies among all neonatal levels of care, with the greatest increase among Level IV criteria [9].

Using CDC LOCATe[SM] data as a standardized assessment allows states and jurisdictions to delineate facilities by level of neonatal care and distribution of personnel and services. Depending on state-specific priorities and capacity, jurisdictions can link CDC LOCATe[SM] results with additional public health surveillance data, including hospital discharge and vital records data. Linking CDC LOCATe[SM] data to vital records, such as infant birth and death certificates, can produce detailed comparisons of patient demographics and outcomes among

delivery facilities across a state [11]. These linked data can be used for analyses to inform risk-appropriate care, for example, by examining the proportion of VLBW and very preterm births in the state that occur at Level III + facilities, and whether disparities exist by urban-rural counties, maternal insurance, maternal race/ethnicity, or other social determinants of health. Given the variety of data collected by CDC LOCATe^{SM}, states and jurisdictions can further analyze data using facility responses not used to assess their level of neonatal care. For example, a state may choose to further analyze whether participating facilities receive high-risk and/or convalescent neonates, and whether they coordinate emergency transport for neonates, to help inform the implementation of neonatal risk-appropriate care systems in the state. Opportunities to further use findings from CDC LOCATe^{SM} include analyzing differences in outcomes between, and within, levels, including provider availability, equipment, or procedure volume, and analyzing facility-level statistics for volume of births and transfers of VLBW and very preterm infants to higher levels of care. Jurisdictions may choose to examine outcomes by both self-reported level of neonatal care and CDC LOCATe^{SM}-assessed level of neonatal care for these types of analyses. These analyses may also benefit from the linking of transfers.

Limitations exist in this analysis. The information presented is based on facility self-reported data, which may be subject to inaccuracies due to variation in the interpretation of CDC LOCATe^{SM} questions and the role of individuals assigned to complete the assessment. Although CDC offers technical assistance and communicates with jurisdictions to resolve data issues, some discrepancies may still exist. Participating health facilities may not respond to inquiries regarding discrepancies in their data before results are returned. Further, the generalizability of these findings beyond the 20 participating jurisdictions is limited. It is possible the jurisdictions that self-selected to participate in CDC LOCATe^{SM} may differ from other jurisdictions in terms of knowledge and prioritization of levels of neonatal care and risk-appropriate care. Our current analysis does not assess whether participating jurisdictions have regulatory policies on levels of neonatal care designation. It is possible that knowledge of levels of neonatal care also varied by whether jurisdictions had policies in place, which may have affected self-reported data in CDC LOCATe^{SM}. We were also unable to incorporate patient-level neonatal outcomes in this analysis. Finally, just as consistency has increased in state neonatal levels of care policies over time [9], discrepancies may have also changed over time; this analysis was unable to account for discrepancies by year.

Increasing understanding of the geographic distribution of perinatal services and providers supports a broadened understanding of perinatal regionalization. Monitoring and oversight and the inclusion of levels of neonatal care regulation language in policy and program guidelines can improve access to risk-appropriate care for pregnant persons and neonates [10]. A comprehensive assessment of AAP levels of neonatal care policy elements, as assessed by CDC LOCATe^{SM}, allows for opportunities to promote perinatal regionalization across, and within, states. Improved systems of risk-appropriate neonatal care is a strategy to improve outcomes related to newborn infant morbidity and mortality [22].

ACKNOWLEDGEMENTS

We want to thank the implementing agencies responsible for CDC LOCATe[SM] in each jurisdiction that provided CDC LOCATe[SM] data included in this analysis. Any published findings and conclusions do not necessarily represent the official position of the jurisdictions that participated in CDC LOCATe[SM]. This project was supported in part by an appointment to the Research Participation Program at the Centers for Disease Control and Prevention administered by the Oak Ridge Institute for Science and Education through an interagency agreement between U.S. Department of Energy and the Centers for Disease Control and Prevention.

DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are not publicly available due to data being owned by participating jurisdictions, but are available from the corresponding author on reasonable request.

REFERENCES

1. March of Dimes (2011) Toward improving the outcome of pregnancy III: Enhancing perinatal health through quality, safety and performance initiatives. https://www.marchofdimes.org/materials/toward-improving-the-outcome-of-pregnancy-iii.pdf. Accessed 28 May 2021.
2. Ryan GM Jr. (1975) Toward improving the outcome of pregnancy: Recommendations for the regional development of perinatal health services. Obs Gynecol. 46:375–84.
3. Little GA, Merenstein GB (1993) Toward improving the outcome of pregnancy, 1993: Perinatal regionalization revisited. Pediatrics 92:
4. American Academy of Pediatrics. Levels of neonatal care. Pediatrics. 2004;114:1341–7. [PubMed: 15520119]
5. American Academy of Pediatrics; Committee on Fetus and Newborn. Levels of neonatal care. Pediatrics. 2012;130:587–97. [PubMed: 22926177]
6. AAP Committee on Fetus and Newborn, ACOG Committee on Obstetric Practice (2017) Guidelines for Perinatal Care, 8th Edition.
7. Lasswell SM, Barfield WD, Rochat RW, Blackmon L. Perinatal regionalization for very low-birth-weight and very preterm infants: A meta-analysis. JAMA. 2010;304:992–1000. [PubMed: 20810377]
8. Menard MK, Liu Q, Holgren EA, Sappenfield WM. Neonatal mortality for very low birth weight deliveries in South Carolina by level of hospital perinatal service. Am J Obstet Gynecol. 1998;179:374–81. [PubMed: 9731841]
9. Kroelinger CD, Rice ME, Okoroh EM, DeSisto CL, Barfield WD. Seven years later: state neonatal risk-appropriate care policy consistency with the 2012 American Academy of Pediatrics policy. J Perinatol. 2021;42:595–602. [PubMed: 34253843]
10. Kroelinger CD, Okoroh EM, Goodman DA, Lasswell SM, Barfield WD. Designation of neonatal levels of care: a review of state regulatory and monitoring policies. J Perinatol. 2020;40:369–76. [PubMed: 31570793]
11. Catalano A, Bennett A, Busacker A, Carr A, Goodman D, Kroelinger C, et al. Implementing CDC's Level of Care Assessment Tool (LOCATe): A national collaboration to improve maternal and child health. J Women's Health. 2017;26:1265–9.
12. American College of Obstetricians and Gynecologists, Society for Maternal-Fetal Medicine, Kilpatrick SJ, Menard MK, Zahn CM, Callaghan WM. Obstetric Care Consensus #9: Levels of Maternal Care: (Replaces Obstetric Care Consensus Number 2, February 2015). Am J Obs Gynecol. 2019;221:B19–B30.
13. Centers for Disease Control and Prevention CDC Levels of Care Assessment Tool (CDC LOCATe). https://www.cdc.gov/reproductivehealth/maternalinfanthealth/cdc-locate/participating-state-success-stories.html. Accessed 21 Dec 2021.

14. Madni SA, Ewing AC, Beauregard JL, Brantley MD, Menard MK, Goodman DA. CDC LOCATe: Discrepancies between self-reported level of maternal care and LOCATe-assessed level of maternal care among 463 birth facilities. J Perinatol. 2021;42:589–94. [PubMed: 34857892]
15. Georgia Department of Public Health Maternal and Neonatal Center Designation Program. https://dph.georgia.gov/maternal-and-neonatal-center. Accessed 7 Apr 2022.
16. Texas Department of State Health Services Neonatal System Development. https://www.dshs.texas.gov/emstraumasystems/neonatal.aspx. Accessed 11 Jan 2022.
17. Kattwinkel J, Perlman JM, Aziz K, Colby C, Fairchild K, Gallagher J, et al. Part 15: neonatal resuscitation: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010. 10.1161/CIRCULATIONAHA.110.971119.
18. Ringer SA, Aziz K. Neonatal stabilization and postresuscitation care. Clin Perinatol. 2012;39:901–18. [PubMed: 23164186]
19. Schwartz RM, Kellogg R, Muri JH. Specialty newborn care: trends and issues. J Perinatol. 2000;2000 208 20:520–9. [PubMed: 11190593]
20. Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH. Are neonatal intensive care resources located according to need? Regional variation in neonatologists, beds, and low birth weight newborns. Pediatrics. 2001;108:426–31. [PubMed: 11483810]
21. Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH, Schoendorf KC. The relation between the availability of neonatal intensive care and neonatal mortality. N Engl J Med. 2002;346:1538–44. [PubMed: 12015393]
22. Van Otterloo LR, Connelly CD. Risk-appropriate care to improve practice and birth outcomes. J Obstet Gynecol Neonatal Nurs. 2018;47:661–72.

Table 1.

Service and personnel requirements for level of neonatal care based on 2012 American Academy of Pediatrics Levels of Neonatal Care policy.

	Level I	Level II	Level III	Level IV
Service				
Congenital cardiac surgery				X
Complex pediatric subspecialty surgeries				X
Advanced (complex) imaging			X	X
Complex ventilation			X	X
Conventional mechanical and/or continuous positive airway pressure (CPAP)		X	X	X
Personnel				
Neonatologist		X [a]	X [b]	X [c]
Pediatric surgeon			X [d]	X [e]
Pediatric anesthesiologist			X [d]	X [e]
Pediatric ophthalmologist			X [d]	X [f]

[a] Level II facilities require a neonatologist to be available either by telemedicine only or by phone consultation only.

[b] Level III facilities require a neonatologist to be available either between 30 and 60 min away or more than 60 min away.

[c] Level IV facilities require a neonatologist to be available either onsite 24/7 or within 30 min.

[d] Level III facilities require a pediatric surgeon, pediatric anesthesiologist, and pediatric ophthalmologist to be available either between 30 and 60 min away, more than 60 min away, by telemedicine only, or by phone consultation only.

[e] Level IV facilities require a pediatric surgeon, pediatric anesthesiologist, and pediatric ophthalmologist to be available onsite 24/7 or within 30 min.

Table 2.

CDC Levels of Care Assessment Tool[SM] (CDC LOCATe[SM]) neonatal question phrasing and response format across versions 3–9, 2016–2021.

CDC LOCATe[SM] assessment item	Versions 3–4	Version 5	Version 6	Version 7	Version 8	Version 9
Services	Does your facility provide congenital cardiac surgery for neonates onsite? Yes/No					
	Does your facility provide complex pediatric subspecialty surgery for neonates other than cardiac surgery onsite? (Capable of surgical repair of complex congenital or acquired conditions) Yes/No					
	Does your facility provide advanced (complex) imaging for neonates onsite 24/7 with interpretation available onsite or remotely 24/7? (Example: CT, MRI, echocardiograph) Yes/No					
	Does your facility provide complex ventilation for neonates onsite? (High-frequency ventilation, iNO) Yes/No					
	Does your facility provide conventional mechanical and/or continuous positive airway pressure (CPAP) ventilation support for neonates until the infant can be transferred to a higher level facility? (Ventilation for less than 24 h) Yes/No					
Providers	Does your facility have a neonatologist on staff? Yes/No	What types of neonatal providers does your facility have available for newborn care? (Mark all that apply)				
		• Neonatologist(s) • Pediatric hospitalist(s) • Neonatal nurse practitioner(s) • Other • None				
	Does your facility have a range of pediatric medical subspecialists and pediatric surgical specialists available? Yes/No If yes, do these pediatric medical subspecialists and pediatric surgical specialists include… (Mark all that apply)					
	• Pediatric surgeon(s) • Pediatric anesthesiologist(s) • Pediatric ophthalmologist(s) • Pediatric radiologist(s) • Other pediatric subspecialist(s)					
Provider availability	• Onsite 24/7, OR • Within 30 min, OR • Between 30–60 min, OR • More than 60 min away, OR • By telemedicine only	• Onsite 24/7, OR • Within 30 min, OR • Between 30–60 min, OR • More than 60 min away, OR • By telemedicine only, OR				

CDC LOCATe℠ assessment item	Versions 3–4	Version 5	Version 6	Version 7	Version 8	Version 9
		• By phone consultation only				

Table 3.

CDC Levels of Care Assessment Tool[SM] (CDC LOCATe[SM])-assessed level of neonatal care, facility self-reported level, and discrepancy in assessed and reported level of neonatal care, 2016–2021.

	CDC LOCATe[SM]-assessed level of neonatal care									
	All Levels		**Level I**		**Level II**		**Level III**		**Level IV**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
CDC LOCATe[SM]-assessed level of neonatal care (row %)	765		326	42.6%	325	42.5%	95	12.4%	19	2.5%
Facility self-reported level (column %)										
I	261	34.1%	210	64.4%	51	15.7%	0	0.0%	0	0.0%
II	270	35.3%	78	23.9%	189	58.2%	3	3.2%	0	0.0%
III	141	18.4%	0	0.0%	67	20.6%	69	72.6%	5	26.3%
IV	49	6.4%	4	1.2%	8	2.5%	23	24.2%	14	73.7%
Unknown/None/Blank	44	5.8%	34	10.4%	10	3.1%	0	0.0%	0	0.0%
Discrepancy (column %)										
None	482	63.0%	210	64.4%	189	58.2%	69	72.6%	14	73.7%
Self-reported higher	180	23.5%	82	25.2%	75	23.1%	23	24.2%	-	-
Lacking personnel	151	83.9%	76	92.7%	54	72.0%	21	91.3%	-	-
Lacking service(s)	11	6.1%	2	2.4%	9	12.0%	0	0.0%	-	-
Lacking both	18	10.0%	4	4.9%	13	17.3%	1	4.4%	-	-
Self-reported lower	59	7.7%	-	-	51	15.7%	3	3.2%	5	26.3%
Did not self-report	44	5.8%	34	10.4%	10	3.1%	0	0.0%	0	0.0%

Table 4.

Most common 2012 American Academy of Pediatrics Levels of Neonatal Care policy elements contributing to discrepancies between CDC Levels of Care Assessment Tool[SM] (CDC LOCATe[SM])-assessed level of neonatal care and facilities that self-reported a higher level of neonatal care, 2016–2021.

CDC LOCATe[SM]-assessed level of neonatal care	Element(s) missing for facilities that self-assessed a higher level of care	*N*	%
Level I (n = 82)	Lack of neonatologist	80	97.6%
Level II (n = 75)	Lack of at least one pediatric medical subspecialist/surgical specialist: pediatric surgeon, pediatric anesthesiologist, or pediatric ophthalmologist	67	89.3%
Level III (n = 23)	Lack of availability for at least one pediatric medical subspecialist/surgical specialist: pediatric surgeon, pediatric anesthesiologist, or pediatric ophthalmologist	15	65.2%

Table 5.

Distribution of services and personnel available across CDC Levels of Care Assessment Tool[SM] (CDC LOCATe[SM])-assessed level of neonatal care, 2016–2021[a].

	CDC LOCATe[SM]-assessed level of neonatal care									
	All Levels (*N* = 765)		Level I (*n* = 326)		Level II (*n* = 325)		Level III (*n* = 95)		Level IV (*n* = 19)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Services										
Congenital cardiac surgery	32	4.2%	0	0.0%	9	2.8%	15	15.8%	8[b]	42.1%
Complex pediatric subspecialty surgeries	101	13.2%	0	0.0%	29	8.9%	53	55.8%	19[b]	100.0%
Advanced (complex) imaging[c]	354	46.3%	63	19.3%	177	54.5%				
Complex ventilation[d]	232	30.3%	19	5.8%	99	30.5%				
Conventional mechanical and/or continuous positive airway pressure (CPAP)[e]	504	65.9%	261	80.1%						
Personnel[f]										
Neonatologist	451	59.0%	12	3.7%						
Pediatric surgeon	189	24.7%	3	0.9%	72	22.2%				
Pediatric anesthesiologist	163	21.3%	12	3.7%	37	11.4%				
Pediatric ophthalmologist	203	26.5%	15	4.6%	74	22.8%				

[a]The facilities that were required to have elements are included in the "All Levels" column. Empty cells indicate an element required for a facility to assess at that level, so variation is not possible; all empty cells, by default, represent 100%.

[b]Level IV facilities require either congenital cardiac surgery or complex pediatric subspecialty surgery, but not both.

[c]This includes CT, MRI, and echocardiography.

[d]This includes high frequency ventilation, iNO.

[e]Facilities are not required to have conventional mechanical and/or continuous positive airway pressure (CPAP) if they have complex ventilation.

[f]Availability of pediatric hospitalists, neonatal nurse practitioners, and pediatric radiologists is collected in CDC LOCATe[SM] but is not used for the level of neonatal care assessment and therefore is not included in this table.