PERSPECTIVE

Maternal and neonatal risk-appropriate care: gaps, strategies, and areas for further research

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Risk-appropriate care is a strategy to improve perinatal health outcomes by providing care to pregnant persons and infants in facilities with the personnel and services capable of meeting their health needs. The Association of State and Territorial Health Officials hosted discussions among state health officials, health agency staff, and clinicians to advance risk-appropriate care. The discussions focused on neonatal levels of care, levels of maternal care, ancillary services utilized for care of both populations including transport and telemedicine, and issues affecting provision of care such as standardization of state policies or approaches, reimbursement for services, gaps in risk-appropriate care, and equity. State-identified implementation strategies for improvement were presented. In this Perspective, we summarize current studies describing provision of risk-appropriate care in the United States, identify gaps in research, and highlight ongoing and proposed activities to address research gaps and support state health officials and clinicians.

Journal of Perinatology (2023) 43:817–822; https://doi.org/10.1038/s41372-022-01580-6

INTRODUCTION

Risk-appropriate care is a strategy to improve perinatal health outcomes by providing care to pregnant persons and infants in facilities with the personnel and services capable of meeting their health needs [1]. States or jurisdictions can develop coordinated regional systems based on designated levels of care at each facility [1]. This strategy, sometimes referred to as perinatal regionalization, was first introduced in the 1976 publication *Toward Improving the Outcomes of Pregnancy* (TIOP I) [2], and refined in the later versions (TIOP II and TIOP III) [1, 3]. Risk-appropriate care has continued to evolve based on changes to clinical practice (e.g., surfactant for neonates [4], neonatal head cooling [5], or recognition of severe maternal morbidities [6]). Requirements for levels of care, both neonatal and maternal, are developed through clinical consensus and published by clinical membership organizations such as the American Academy of Pediatrics (AAP) [7] and the American College of Obstetricians and Gynecologists (ACOG) and Society for Maternal-Fetal Medicine (SMFM) [8]. AAP published the original Levels of Neonatal Care guidelines in 2004 [9], which were updated in 2012 [7] and re-affirmed in 2015 [10]. ACOG and SMFM jointly published the original Levels of Maternal Care guidelines in 2015 [11], which were updated in 2019 and re-affirmed in 2021 [8]. For both levels of care guidelines, levels range from I through IV, with Level I facilities providing care for the lowest-risk mothers and neonates, and Level IV facilities providing the most comprehensive care to the highest-risk mothers and neonates [7, 8].

Recent review of publicly available policy sources indicate that half of states have a neonatal risk-appropriate care policy as of 2019 [12], and less than half of states have perinatal guidelines that incorporate levels of maternal care as of 2018 [13]. However, consistency with risk-appropriate care guidelines from AAP and ACOG/SMFM varies by state [12, 13], as does regulation and oversight [13, 14]. For most states with available policies, authority to designate levels of care resides within the state health agency or department, though public/private partnerships may also be designating authorities [14]. State Health Officials or other individuals appointed to lead state health agencies manage delivery of public health services statewide [15, 16], including the coordination of policy and reimbursement for neonatal and maternal care.

Given the roles of both clinical membership organizations and state health agencies in supporting implementation of risk-appropriate care, the Association of State and Territorial Health Officials (ASTHO) in partnership with the Centers for Disease Control and Prevention (CDC), AAP, and ACOG, hosted discussions among state health officials, health agency staff, and clinicians (e.g., obstetrician gynecologists, maternal-fetal medicine specialists, neonatologists, and pediatricians) to advance levels of care for birthing persons and infants [17]. The discussions focused on neonatal levels of care, levels of maternal care, ancillary services utilized for care of both populations including transport and telemedicine, and issues affecting provision of care such as standardization of policies or approaches, reimbursement for services, gaps in risk-appropriate care, and equity. State-identified implementation strategies for improvement were presented. In this article, we summarize current studies describing provision of risk-appropriate care in the United States, identify gaps in research, and highlight ongoing and proposed activities to address research gaps and support state health officials and clinicians.

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Received: 14 September 2022 Revised: 29 November 2022 Accepted: 1 December 2022
Published online: 11 January 2023

RISK-APPROPRIATE CARE IMPLEMENTATION

As of 2019, 30 states and the District of Columbia had policies identifying a designating authority for neonatal levels of care [14]. Of these, 22 required ongoing monitoring through hospital reporting or site visits [14]. Among the 17 state policies identifying site visits as part of the ongoing monitoring process, only 10 required a site visit [14]. State policies defining designating authorities in a levels of care policy may require regular inspection for compliance or certification purposes; for example, Virginia, South Carolina, and Pennsylvania currently require inspection every 2 or 3 years per facility [18–20]. State policies may also define requirements for site visit team composition (e.g., maternal-fetal medicine specialists, hospital administrators), such as policies in Illinois and Iowa [21, 22]. Texas includes a designating authority in the risk-appropriate care policy [23, 24], and the state administrative code includes levels of care specifications [25, 26]. Hospitals in Texas receive designations every 3 years, which includes surveys administered by approved agencies for neonatal and maternal levels of care [24]. However, some states may lack statewide policies, resources, or capacity to identify designating authorities or monitor levels of care [12, 14].

In 2013, CDC developed a tool to assist jurisdictions in assessing facility levels of neonatal and maternal care [27]. This tool, the Levels of Care Assessment Tool (CDC LOCATe^{SM}), has been implemented by 25 states, one territory, one perinatal region, and one large hospital system as of May 2022 [28]. CDC LOCATe^{SM} uses the most recent guidelines from AAP and ACOG/SMFM to produce standardized assessments for each facility and also facilitates stakeholder engagement in jurisdictions on risk-appropriate care [27]. For example, conversations related to CDC LOCATe^{SM} implementation and subsequent results often bring together the public health workforce and clinical champions, including Perinatal Quality Collaboratives, to discuss risk-appropriate care in the jurisdiction [28]. However, CDC LOCATe^{SM} was not developed to be a tool for formal designation of levels of care.

For formal review of facility designation and levels of care monitoring, AAP and ACOG/SMFM developed levels of care verification programs. The AAP neonatal intensive care unit (NICU) verification program, originally launched as an approved survey agency for neonatal levels of care in Texas, is now expanding to provide consultation and verification to NICUs across the United States [29], including recent implementation in Georgia [30]. The program is designed to review Level II, III, and IV NICUs and verify specific levels of neonatal care standards following a survey and on-site assessment. Similarly, in 2017, ACOG piloted a levels of maternal care verification program in 14 hospitals in three states (Georgia, Illinois, and Wyoming) [31]. Delivery facilities completed CDC LOCATe^{SM} as a pre-visit screening, followed by a multi-disciplinary team on-site, comprehensive review of results and availability of maternity services at each facility. The ACOG levels of maternal care verification program is providing survey services to verify compliance with the Texas administrative code specifications for levels of maternal care [32]. As of January 2022, ACOG is partnering with The Joint Commission on a maternal levels of care verification program, which includes a comprehensive on-site review to verify the level of maternal care provided at individual Level I, II, III, and IV facilities [33, 34]. Georgia hospitals are implementing the Joint Commission maternal levels of care verification program in partnership with the Department of Public Health [30], and Florida hospitals are implementing the Joint Commission maternal levels of care verification in partnership with the Florida Perinatal Quality Collaborative [35].

Verification programs typically involve fees, which may be burdensome, particularly for smaller or rural hospitals. Cost-sharing, as the Georgia Department of Public Health [30] and the Florida Perinatal Quality Collaborative [35] are doing for their verification programs, can offset fees. In Georgia and Florida, a portion of the cost of the facility surveys by The Joint Commission will be covered by the Georgia Department of Public Health [30] and Florida Perinatal Quality Collaborative [35], respectively.

Some states allow for self-designation by individual delivery facility [14, 36]. However, self-designation may not align with levels of care guidelines. For example, 46% of facilities that have completed CDC LOCATe^{SM} had a discrepancy between their self-reported level of maternal care and their CDC LOCATe^{SM}-assessed level of maternal care [37]. Among facilities with discrepancies, 89% self-reported a higher level of maternal care than their CDC LOCATe^{SM}-assessed level of maternal care [37]. Similarly, 33% of facilities that have completed CDC LOCATe^{SM} had a discrepancy between their self-reported level of neonatal care and their CDC LOCATe^{SM}-assessed level of neonatal care [38]. Among facilities with discrepancies, 75% self-reported a higher level of neonatal care than their CDC LOCATe^{SM}-assessed level of neonatal care [38]. A consequence of self-designation not aligned with levels of care guidelines is the possible admittance and treatment of patients who require care beyond facility capabilities or staffing [37]. Quality and safety are essential components of levels of care assessment and verification [29, 33, 39]. Level III and IV facilities, including regional perinatal centers, can provide education, training, and resource support to Level I and II facilities, helping to ensure patients and families receive the most appropriate care [40].

Part of risk-appropriate care is ensuring pregnant persons and infants are transferred based on risk assessment [40, 41]. As of 2019, 42 states had policies for neonatal transport and 37 states had policies for maternal transport [42]. Negotiated regionalized maternal and neonatal emergency transport, based on geography and risk, is a model used in geographically remote, frontier states such as Alaska [43, 44] or Hawaii [45, 46]. In Alaska, critical care air and ground transport are authorized without prior authorization to higher-level facilities for labor and delivery complications or newborn complications within the first 24 h following birth [43]. Arizona coordinates transport and follow-up care through a high-risk perinatal program, offering additional home visits with active education and outreach through community nursing services following hospital discharge [47]. In densely populated areas, transport can be affected by a variety of factors, such as the concentration of facilities with similar or higher capabilities and staffing and patient illness acuity [48].

Although perinatal risk-appropriate care is typically provided in-person, telemedicine is also sometimes used to provide distance-based consultation, diagnosis, and treatment [49]. As of 2014, 32 states had published telemedicine policies, but only 3 specified language directly addressing perinatal care [49]. Telemedicine has continued to develop for disease diagnosis and management, consultation on complex cases, patient education, and virtual visitation, but not for emergency care [50]. For example, Arkansas supports telemedicine to engage maternal-fetal medicine specialists for co-management of patient counseling, consultation, and referral of both maternal and neonatal patients [51]. A study of data from 2014–2018 found that telemedicine consultations with a neonatologist can be helpful for stabilizing infants before the arrival of a transport team for a transfer to a higher level of care [52]. As technology continues to advance, jurisdictions can explore how transport and telemedicine can be used together as part of the system of risk-appropriate care for improving perinatal outcomes.

REIMBURSEMENT FOR SERVICES

State risk-appropriate care policies can include content on reimbursement for services such as perinatal transport. The number of states with neonatal and maternal transport reimbursement policies—defined as policies including language on the reimbursement of transport by a state program or by insurance

companies, including Medicaid—increased from 2014 to 2019 [42]. Yet, there was not an increase in the number of states with reimbursement policies for back-transport [42]. Back-transport can support familial bonding, ease financial and emotional stress on parents and caregivers, promote earlier involvement of primary care providers, improve efficiency of NICU bed utilization, and generate net cost savings [53–58]. However, a hospital caring for a sick infant may not be incentivized to back-transport the infant to a lower-level facility because convalescing care reimbursement would likely be received by the institution receiving the transfer rather than the facility initiating the transfer [53]. Similarly, providers may be disincentivized from transferring a patient before delivery when maternity care is bundled into a payment tied to the provider attending the delivery [59].

Patient insurance coverage can influence where a delivery occurs and which hospitals are available for patient transfer [60]. One study from southeastern Pennsylvania found that neonates with no insurance and those with Medicaid coverage were more likely to be transferred than infants with private insurance [61]. Examination of a national sample of pregnant persons by demographic characteristics indicated that those with private insurance were less likely to be transferred during labor and delivery compared with persons using other sources for payment, though it is unclear if private insurance limited transfer options or promoted initial admission to an appropriate higher-level facility [62].

Telemedicine policies also impact reimbursement for services. Many flexibilities to telemedicine delivery have been created in the context of the COVID-19 pandemic, including many state governments expanding telehealth in their Medicaid programs and mandating fully-insured private plans to cover and reimburse for telemedicine services [63, 64], although it is unclear if these measures will remain after the end of the public health emergency. Secure platforms for telemedicine are more widely available and many previous restrictions have been lifted in the context of the COVID-19 pandemic (e.g., allowing phone visits to qualify as telemedicine, allowing clinicians to practice across state lines) [64]. Some states now allow hospitals to provide services to other hospitals via telemedicine; for example, genetic counselors may be able to serve patients at other hospitals without in-person contact [65, 66]. Telemedicine can increase access to perinatal specialists [67]. Policies that require insurers to pay for telehealth are associated with increased adoption of telehealth services [68]. Telemedicine services may be cost-saving for patients with specific conditions such as neonates requiring resuscitation and stabilization at lower-level facilities through consultation with specialists, reducing transfer costs and supporting family-centered, community care [69].

HEALTH EQUITY

Inequities in care during delivery hospitalization and NICU admission exist [70–75]. Providing culturally congruent, competent care is an approach to reduce disparities in neonatal outcomes [70]. Perceived racial-ethnic discrimination during childbirth is a potentially modifiable aspect of the patient experience, and interventions to reduce obstetric healthcare disparities can address perceived discrimination, both from the provider and patient perspectives [73]. A qualitative study of mothers whose babies required NICU stays found that care experiences were largely positive, but some suggested poorer communication and responsiveness to Black and Latina mothers [76]. Hospital quality of care may influence racial and ethnic disparities; one study found that Black and Hispanic women deliver at hospitals with worse outcomes for women and very preterm infants [77], and another study by the same authors in New York City focusing on low-risk neonates found that Black and Hispanic women were more likely to deliver in hospitals with high complication rates compared to White or Asian American women [74]. Quality improvement initiatives, such as those implemented by Perinatal Quality Collaboratives, or networks of providers working to improve quality care among birthing people and newborns [78], offer context for diffusion of equitable, best clinical practices [71]. Maternal safety bundles to reduce racial and ethnic disparities provide resources to address differences in care structure through recognition of biases at the systems level [79]. Focusing care on the maternal-infant dyad by revising clinical protocols and quality metrics that track processes, care, and disparities may impact longer-term health trajectories for families and holistically address disparities [80].

Some state health departments have developed health equity roadmaps to inform programmatic use of data to improve services and address racial disparities in health outcomes [81, 82]. The Massachusetts Department of Public Health's roadmap is used to identify structural and institutional racism in existing public health programs, highlight disparities in provision of program services, describe how to communicate inequities to stakeholders, frame key messages to the public, and monitor programmatic changes implemented to eliminate disparities [81]. The roadmap is intended to be iterative and adaptive as programs utilize quality improvement methods to make changes based on contextual data findings [81]. Similarly, the Michigan health equity roadmap addresses disparities by acknowledging the shared responsibilities of clinical care and public health in partnering to reduce inequity by ensuring full access to quality healthcare [82].

Where pregnant people deliver may be affected by service availability [83–85]. Hospital closures, especially in rural areas and minority communities, can disrupt care in communities [83–86]. Further, the inequitable access to high-speed internet or broadband across the country may affect the availability of telemedicine services [87].

FUTURE OPPORTUNITIES

Gaps in research and evaluation on risk-appropriate care remain. Though the evidence for improved neonatal outcomes in Level III and IV NICUs has been established [88, 89], there is a need for more evidence of improved outcomes in higher levels of maternal care. Further research on outcomes after an infant back-transport is needed to inform care for infants and families. Additional gaps in understanding disparities by race, ethnicity, and other social determinants of health linked to maternal morbidity and infant outcomes could be addressed in future state-based or regional analyses of levels of maternal and neonatal care. Similarly, collection and analysis of qualitative data can be used to examine risk-appropriate care including family perspectives, knowledge, and attitudes about care. These qualitative data could help create opportunities to improve education about levels of care for community members and refine the language and communication used by clinical and public health experts when describing risk-appropriate care. Further, more research on telemedicine as a strategy to address the challenges of hospital closures and other gaps in service availability is warranted. Finally, future implementation research can be used to study strategies for implementation of systems of risk-appropriate care by states or perinatal regions.

To address identified approaches and gaps related to risk-appropriate care implementation, in partnership with CDC, ASTHO began a Risk-Appropriate Care Learning Community in 2022. The Learning Community leverages technical assistance and peer-to-peer learning to improve equitable risk-appropriate care practices in participating states. The Learning Community targets the strengthening of health systems in perinatal regions within states and inclusion of families and communities to promote equitable services for all pregnant and postpartum people and newborns. The Learning Community provides an opportunity for continued integration and collaboration between public health department

leadership, clinical leaders, and other partners with interest in risk-appropriate care.

CONCLUSION

Discussions between public health and clinical leaders [17] are valuable for highlighting emerging issues in risk-appropriate care. By focusing on current state implementation, clinical guidelines, patient transfer, and telemedicine, approaches such as identifying needed systems changes, improving financing and reimbursement, and addressing health equity were identified. Gaps identified include the need to develop further evidence for higher levels of maternal care and infant back-transport, and the need to understand family perspectives through use of qualitative data.

Much progress has been made in perinatal risk-appropriate care since the publication of TIOP I in 1976, largely owed to the ongoing collaboration between clinical and public health leaders. A continued focus on access to risk-appropriate care may increase equity in care and outcomes in the United States and help ensure birthing persons and infants receive the care they need when they need it.

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.

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ACKNOWLEDGEMENTS

The authors thank the American Academy of Pediatrics (AAP), the American College of Obstetricians and Gynecologists (ACOG), Society for Maternal-Fetal Medicine (SMFM), and the convening participants.

AUTHOR CONTRIBUTIONS

CLD, CDK, and ML conceptualized the work and drafted the paper. SA, EP, and WDB revised the paper critically for important intellectual content.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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