

Assessment of State Measures of Risk-Appropriate Care for Very Low Birth Weight Infants and Recommendations for Enhancing Regionalized State Systems

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Abstract The goal of this study was to examine state measurements and improvements in risk-appropriate care for very low birth weight (VLBW) infants. The authors reviewed state perinatal regionalization models and levels of care to compare varying definitions between states and assess mechanisms of measurement and areas for improvement. Seven states that presented at a 2009 Association of Maternal & Child Health Programs Perinatal Regionalization Meeting were included in the assessment. Information was gathered from meeting presentations, presenters, state representatives, and state websites. Comparison of state levels of care and forms of regulation were outlined. Review of state models revealed variability in the models themselves, as well as the various mechanisms for measuring and improving risk-appropriate care. Regulation of regionalization programs, data surveillance, review of adverse events, and consideration of geography and demographics were identified as mechanisms facilitating better measurement

of risk-appropriate care. Antenatal or neonatal transfer arrangements, telemedicine networks, acquisition of funding, provision of financial incentives, and patient education comprised state actions for improving risk-appropriate care. The void of explicit and updated national standards led to the current variations in definitions and models among states. State regionalization models and measures of risk-appropriate care varied greatly. These variations arose from inconsistent definitions and models of perinatal regionalization. Guidelines should be collaboratively developed by healthcare providers and public health officials for consistent and suitable measures of perinatal risk-appropriate care.

Keywords Perinatal regionalization · Risk-appropriate care · Very low birth weight infants · Neonatal levels of care

Purpose

Perinatal regionalization was initially outlined in the 1976 March of Dimes publication, *Toward Improving the Outcome of Pregnancy (TIOP)*, as an effort to identify high risk pregnancies and provide appropriate care [1]. Perinatal regionalization was defined as a coordinated system of care that offered a full range of services to mothers and infants, appropriate technology, and adequately matched delivery and care. The *TIOP I* recommendations emphasized a comprehensive assessment of mother, fetus, and course of pregnancy to identify high-risk deliveries and neonates. The most appropriate facility for delivery was determined based on patient risk factors. Regionalization provided the infrastructure for placing patients in appropriate clinical care facilities. A follow up to these guidelines was published in *TIOP II*, which placed emphasis on identifying high risk pregnancies

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in the ambulatory care setting [2]. Both *TIOP I* and *II* listed three levels of perinatal care to address the varying demands of high to low risk pregnancies. The recommendations for levels of care continue to be routinely updated in *Guidelines for Perinatal Care (GPC, Table 1)* [3].

The evolution of these perinatal guidelines has shifted from a more comprehensive assessment of pregnancy to quantification of risk by infant birth weight [4]. Early

gestational age and low birth weight are both risk factors for infant morbidity and mortality. However, birth weight is a more quantifiable measurement and has served as a standardized indicator of a high-risk neonate. A common measure of risk-appropriate care is calculated by the percentage of very low birth weight (VLBW) infants born at high-risk facilities. National objectives and measurements use percentage of VLBW infants born at high-risk facilities as a proxy for risk-appropriate care. For example, the Healthy People 2010 National Objective 16.8 is to “increase the proportion of very low birth weight (VLBW) infants born at level III hospitals or subspecialty perinatal centers” to a target goal of ninety percent [5]. However, only five states are above the national goal [6]. The desired outcome of this objective is to increase infant survival. Although VLBW infants account for only 2% of all births, they comprise over 50% of neonatal mortality [7, 8]. Research indicates high-risk infants have better outcomes when born at better equipped facilities [9–12]. A recent meta-analysis revealed a 62% increased odds of neonatal/pre-discharge mortality when VLBW infants are born at lower level facilities compared to birth in a level III facility [13].

Despite recommendations made by *TIOP I, II*, and *GPC*, no defined standard for designating levels of care or regulation of risk-appropriate care is required by federal law or national accrediting bodies. The absence of mandated criteria has created state variations in definitions of levels of care and in development of regionalized systems. Measurement of care is often based on hospital level designation, with level defined and determined by the state and its regulatory entities. Some states have used vital statistics and hospital-level information to measure risk-appropriate care, while other states have invested resources into developing new data sources and measurements. The primary goal of this study is to examine state successes in defining, measuring, and improving risk-appropriate care for VLBW infants, which are defined as infants weighing less than 1,500 g at birth. We consider states with differing approaches to perinatal regionalization. The objectives of this article are (1) to examine and compare state models of perinatal regionalization and risk-appropriate care, (2) to identify mechanisms of measurement for risk-appropriate care, and (3) to determine actions for improvement of risk-appropriate care. The intent of this article is to encourage public health officials and healthcare providers to set and follow (or implement) standard definitions and measurements of risk-appropriate care.

Description

In our evaluation seven states were chosen to illustrate the diversity of approaches to regionalization. All states

Table 1 Guidelines for classification of neonatal care facilities

Level, services, and restrictions	Description
Level I (Basic Care): General Definition of Care	Provides care expected of any inpatient maternal and neonatal facility
Services	Evaluation of healthy newborns, routine postnatal care, and resuscitation, stabilization, and transfer of neonates when necessary
Restrictions	Infants born >37 weeks GA; Stabilize and care for infants 35–37 weeks GA who remain stable; and stabilize ill infants born <35 weeks GA until transfer to higher level facility
Level II (Specialty Care): General Definition of Care	Provides care to ill infants prior to transfer, and provides care to convalescing infants following intensive care
II A: Specialty Services	Ventilation only to stabilize and transfer the infants
Restrictions	Infants born at >32 weeks GA and weigh >1,500 at birth
II B: Specialty Services	Ventilation <24 h or continuous positive airway pressure
Restrictions	Infants born at >32 weeks GA and weigh >1,500 at birth
Level III (Subspecialty Care): General Definition of Care	Provides comprehensive care to high-risk neonates and life support as long as necessary
III A: Subspecialty Services	Sustained mechanical ventilation, but no advanced life support
Restrictions	Infants born at >28 weeks GA and weigh >1,000 at birth
III B: Subspecialty Services	Advanced respiratory support, and on-site pediatric medical subspecialists, surgical subspecialists, and anesthesiologists
Restrictions	Infants born at ≤28 weeks GA and weigh ≤1,000 at birth
III C: Subspecialty Services	Extracorporeal life support and open-heart surgery capabilities
Restrictions	No restrictions for gestational age or birth weight

Adapted from *Guidelines for Perinatal Care* [3]

presented at the Association of Maternal and Child Health Programs (AMCHP) Perinatal Regionalization Meeting in October 2009 to discuss issues of access to appropriate facilities for high-risk deliveries and neonates [14]. These states were selected based on their diverse geographical locations, historical approaches to perinatal regionalization, and current efforts to improve access to risk-appropriate care. The meeting brought together leading authorities at the forefront of their state's perinatal regionalization programs to share their experiences. The majority of these spokespersons are division directors within their state's department of health. A comparative evaluation was conducted using information from the AMCHP meeting presentations and presenters, Title V program representatives, and state department of health websites. The Title V program representatives were responsible for distributing and overseeing federal funding for state maternal and child health programs. These multiple sources provided a comprehensive review of each state's regionalization program.

Assessment

Comparison of state models of perinatal regionalization and risk-appropriate care considered definitions for levels of care, clinical capacity, population served and regulatory oversight. Mechanisms of measurement included direct data collection, review of adverse events, and consideration of geography and demographics. Actions taken by states to improve risk-appropriate care involved promoting appropriate transfers, facilitating communication among health-care professionals, obtaining additional funding, providing financial incentives, and promoting public awareness. These various state approaches to risk-appropriate care were reviewed and areas for further evaluation described.

State Comparisons of Risk-Appropriate Care

When comparing models of perinatal regionalization and risk-appropriate care by state, variation exists in level definition (what services are provided at levels I, II and III+), clinical capacity (in terms of staffing and patient volume), and population served (e.g., cutpoints for birth weight and/or gestational age) (Table 2). In fact, many states only define highest risk populations such as very low or extremely low birth weight infants. Additionally, only a fraction of the states include transport in the definition of levels of care. Some states define additional sub-levels of care based on patient volume and availability of clinical procedure.

State regulation of perinatal regionalization is one such means for improving the quality of implementation of

risk-appropriate care. Yet even in regulation of care, variation exists in the type and amount of regulatory oversight (Table 3). Although the states included in this assessment comprise a fraction of the US, they represent the spectrum in terms of regulatory oversight of risk-appropriate care. As shown in the table, states with voluntary regulation of level designations are only provided input from hospitals, a disadvantage when involving other agencies is key for determining well-defined systems (i.e., state health departments, legislative bodies).

New York State demonstrates a mature, well-established, all encompassing perinatal care system regulated by the state government. The New York model relies upon Regional Perinatal Centers (RPC) to provide oversight of affiliated lower level facilities. All obstetrical hospitals are designated as a level I, II, III or RPC based on standard criteria in accordance with American College of Obstetricians and Gynecologists and the American Academy of Pediatrics (ACOG/AAP) guidelines for perinatal care. By regulation, all affiliated hospitals are required to have an agreement with their RPC that specifies the relationship between the RPC and affiliate, including criteria for consultation and transport of higher risk women and neonates. RPC responsibilities to affiliate hospitals include review of hospital data, recommendations for improved care, site visits, training, grand rounds, and review of sentinel events. This approach supports comprehensive data collection, uniformity of guidelines, and systematic dissemination and enforcement of policy [15]. However, a highly controlled government system is not necessarily the best fit for all states. By contrast, in Colorado the Colorado Perinatal Care Council has constructed a peer-review model for monitoring and classifying facilities [16]. While adoption of recommended guidelines is voluntary, Colorado reports hospital compliance to be high [14]. Whether government enforced or voluntarily formed, a central body to set standards and gather data on high risk women and neonates is ideal for determination of risk-appropriate care.

Mechanisms to Measure Risk-Appropriate Care

Direct data collection provides the basis for assessing the quality and implementation of risk-appropriate care. Currently, multiple surveillance systems provide information for measuring the quality of risk-appropriate care. Information provided by vital records and hospital discharge systems include information on infant age, weight, and diagnosed condition. Such information is used in calculating National Performance Measures (NPM) to estimate quality of care across the US. Additionally, review of adverse events among infants and children, specifically, when a fetal or infant death occurs, provides further information for assessing both the quality of care and

Table 2 State levels of perinatal care by specific services, birth outcome, staffing, and volume

	Level I	Level II	Level III
Arkansas^a	Well baby care	Ability for continuous positive airway pressure (CPAP)	Prolonged ventilator capacity
Services	Resuscitation, stabilization, transportation as needed	Ability for brief mechanical ventilation (<24–48 h)	Subspecialists (beyond neonatologist) is facility dependent
BW or GA	≥1,500 g & ≥35 weeks	≥1,500 g & ≥32 weeks	<1,500 g & <32 weeks
Staffing	1 person with neonatal resuscitation training to be present at all deliveries	General pediatric coverage Personnel and equipment available at all times (24/7) for respiratory therapists, radiographs, chemistries, and blood gases	Continuous neonatology coverage in addition to level II requirements
Volume	–	–	–
New York^b (Perinatal care)	Comprehensive maternal and newborn service for low-risk pregnancies and newborns	High-risk newborns & women with potential for a moderately complicated or high-risk delivery	High-risk patients requiring a high level of specialized care
Services	Resuscitation, stabilization, and assisted ventilation of newborns	Standard short-term mechanical ventilation for no more than 4 days	Long-term standard mechanical ventilation; may include ECMO
BW or GA	≥2,500 g & ≥36 weeks	≥1,250 g & ≥30 weeks	Any BW or GA
Staffing	Physician or licensed midwife Radiologist or obstetrician for interpretation of ultrasound scans	Neonatologist available on-site within 20 min 24/7	MFM & neonatal specialist available on-site in 20 min 24/7 Other subspecialists available for consult
Volume	–	≥1,200 high-risk newborn days/year	≥2,000 high-risk newborn days/year
Colorado^c	Basic services for uncomplicated obstetric and newborn patients	Moderately ill infants with mild to moderate complications	Sub-specialty services with neonatal surgery
Services	Basic services	II A—Resuscitation and stabilization of preterm or ill infant II B—Brief mechanical ventilation (less than 24 h) or continuous positive airway pressure	III A—Conventional mechanical ventilation & minor surgical procedures III B—Advanced respiratory care as long as required III C—ECMO and repair of complex congenital cardiac malformations requiring bypass
BW or GA	–	≥1,500 g & ≥32 weeks	III A ≥28 weeks & ≥1,000 g III B <28 weeks & <1,000 g
Staffing	–	–	III B: On-site pediatric medical & surgical subspecialists
Volume	–	–	–
Tennessee^d	Basic care	Mild to moderate infant illness	Severe infant illness
Services	Basic services	II A—Uncomplicated to mild illness II B—More complicated illness	For most complex neonatal illnesses
BW or GA	≥2,000 g & ≥35 weeks	II A— ≥34 weeks II B—Not specified	–
Staffing	None specified	II A—Board certified obstetric and pediatric co-directors II B—Pediatrician board certified in neonatal-perinatal medicine; OB board certified in specialty	Onsite pediatric subspecialists Pediatric co-director is board certified in neonatal medicine Obstetric co-director is board certified in MFM
Volume	–	–	–
Kentucky^e	CON certification requires consistency with latest GPC	CON certification requires consistency with latest GPC	CON certification requires consistency with latest GPC
Florida			
NICS ^f : Services	Well-baby care services Resuscitation, stabilization, transportation as needed	Ventilation services ≥6 h of nursing care a day	≥12 h of nursing care per day Complex neonatal surgery Continuous cardiopulmonary support services

Table 2 continued

	Level I	Level II	Level III
RPICC ^g : Services	N/A	For any stable neonates transferred from a RPICC Level III (step down) Short-term assisted ventilation	Total intensive care including total respiratory support
NICS: BW & GA	None specified	≥1,000 g	Any BW or GA requiring services
RPICC: BW & GA	N/A	N/A (all transferred from level III)	All BWs depending on condition: a. Neonates ≥1,500 g b. Neonates 1,500–2,500 g if: Birth asphyxia, O ₂ dependent respiratory disease c. Neonates ≥2,500 g if: Birth asphyxia, supplemental O ₂ needed ≥24 h
NICS: Staffing	–	Neonatologist for 24-h coverage Head nurse with NICU training Nurse: Infant ratio = 1:4	Level II requirements plus: MFM specialist Pediatric Cardiologist Nurse: Infant ratio = 1:2
RPICC: Staffing	–	Same as NICS staffing	Neonatologists for RPICC, Director-level Neonatologists, Pediatric Surgeons, & Cardiologist 24/7 availability Nurse: Infant ratio = 1:2
NICS: Volume	None specified	Minimum of 1,000 live births/year	Minimum of 1,500 live births/year
RPICC: Volume	–	Not directly specified, same NICS requirements for level designation	Not directly specified, same NICS requirements for level designation
California^h	<i>Intermediate NICU</i>	<i>Community NICU</i>	<i>Regional NICU</i>
Services	Two levels of care: intermediate and continuing	Three levels of care: intensive, continuous, and intermediate and continuing	Same Levels of care as with Community NICU
BW or GA	–	–	–
Staffing	Intermediate care: 8–12 h of nursing care (by RN) per day Continuing care: 6–8 h nursing care (by RN) per day	Intensive care: 12 or more hours of nursing care per day Continuous care: cardiopulmonary monitoring Intermediate and continuing care: as specified above	Ability to provide neonatal surgery
Volume	–	–	–

BW birth weight, GA gestational age, ECMO extra corporeal membrane oxygenation, MFM maternal-fetal medicine, O₂ oxygen

^a Arkansas recommends transfer to level 4 facility, but no recommendations are made for level 4 guidelines [35]

^b New York designates RPCs as level 4, have capability of neonatal surgery and ECMO, added responsibility of overseeing network affiliates [15]

^c Colorado-[14]

^d Tennessee—is currently drafting new version of guidelines [43]

^e Kentucky-[44]

^f Neonatal Intensive Care Services—determines designation of levels [27]

^g Regional Perinatal Intensive Care Centers—determines regionalization guidelines [20]

^h California—designates Intermediate, Community, and Regional classifications rather than numeric levels; not a direct translation but classifications described under most corresponding level; Birth weight, gestational age, and volume requirements not addressed in guidelines [14]

implementation of state programs to reduce these outcomes. Understanding the impact of location of risk-appropriate care centers on infant health is another mechanism used in determining effective implementation of services. Finally, identification of risks associated with the most vulnerable deliveries (e.g., VLBW) increases effectiveness of interventions aimed at increasing risk-appropriate care in regionalized systems.

States frequently use information from birth and death certificates and hospital discharge systems to provide information for reporting on NPM as required by federal agencies in conjunction with use of funds. For example, NPM that have been determined by the Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB) as a requirement of the Title V Maternal and Child Health Services Block Grant, serve as a

Table 3 Forms of state regulation for perinatal regionalization by legislatively mandated status and voluntary status

State	Statute or body responsible for level designation	Description
<i>Statutory mandate</i>		
New York^a	Official Compilation of Codes, Rules, and Regulations of the State of New York: Title 10	State commissioner grants facility certification, level designation, and state law requires all hospital-based perinatal care services participate
Florida^b	Statute (F.S.) 59C-1.042 Neonatal Intensive Care Services F.S. 64C-6.001-6.003 Regional Perinatal Intensive Care Centers Program	Requires “Certificate of Need” for establishment of level I, II, or III Establishes the regional system and defines two levels of Regional Perinatal Intensive Care Centers (RPICC)
Kentucky^c	Kentucky Chapter 216B Licensure and regulation of Health Facilities and Services	Certificate of need required for establishment of level II or III facility, and hospitals must document consistency with latest American Academy of Pediatrics and American College of Obstetricians and Gynecologists’ recommendations and guidelines
<i>Voluntary designation by government organization</i>		
California^d	California Children’s Services (CCS)	Grants licenses & assigns level of care after site review by physician, nurse, social worker, and Neonatal Intensive Care Unit (NICU) technical advisory committee
<i>Voluntary designation by hospitals</i>		
Colorado^e	Hospital Self-Designation	Collaboration with Colorado Perinatal Care Council (CPCC) a volunteer, non-profit, advisory group which begins the process with a hospital self-assessment reviewed by the CPCC Board
Arkansas^f	Hospital Self-Designation	Hospital may involve Antenatal and Neonatal Guidelines, Education, and Learning System (ANGELS); an organization that has drafted Regionalization Guidelines) in the process, but ANGELS does not designate levels
Tennessee^g	Hospital Self-Designation	Guidelines prepared by Subcommittee on Regionalization and Care Levels of the Perinatal Advisory Committee

^a New York-[15]^b Florida-[20, 27]^c Kentucky-[44]^d California-[14]^e Colorado-[14, 16]^f Arkansas-[35]^g Tennessee-[14, 43]

measure of reported state performance and proxy for the quality of health care and treatment. NPM #17 serves to measure access to risk-appropriate perinatal care and is defined as the percent of VLBW infants delivered at facilities for high-risk neonates [17]. However, there are challenges to consistent reporting of NPM #17 by states; e.g., a recent report evaluating the use of NPM #17 by states cites challenges in determining which hospitals are facilities for high-risk neonates [18], and multiple state interpretations of NPM #17 wording has led to diminished accuracy of level classification and other variations in reporting [19].

Hospital discharge information is useful when evaluating the types of services and therapies provided to neonates. For example, information provided by hospital discharge systems includes diagnosis codes and billable treatments administered for live-born infants admitted and

discharged from the Neonatal Intensive Care Unit (NICU). However, hospital discharge data may be restricted by institutions and states as provision of data is hospital dependent. An opportunity for overcoming barriers to accessing data is implementation of a statewide surveillance system. Both New York and Florida have constructed such systems as means of monitoring perinatal regionalization efforts. New York tracks statistics through the Statewide Perinatal Data System, an internet based data submission and retrieval system. Statewide reporting of vital records, surveillance, quality improvement, and enrollment of newborns covered under Medicaid is achieved via the data system [15]. Florida began the Regional Perinatal Intensive Care Center (RPICC) Data System to collect data and assess the impact of the RPICC Program on perinatal mortality/morbidity. The system is not all-inclusive as it lacks data from non-RPICC hospitals.

However, RPICCs are the birth centers for the majority of high-risk deliveries. Therefore, the data system provides detailed information regarding care and outcomes of high-risk neonates [20]. A statewide database provides a quantitative source for determination of risk-appropriate care.

Adverse event reviews are forums that require assessment of risk-appropriate care. Hospital review of sentinel events is required for accreditation by the Joint Commission on Accreditation of Healthcare Organizations [21]. Institutions identify and review causes of sentinel events, design a plan aimed at risk reduction, and monitor plan effectiveness. However, as reviews occur within the institution, often the state public health officials do not have full access to data. Some states have Child Fatality Review Programs (CFRP), which review causes of mortality in all persons under the age of 18 including neonatal and infant deaths. Colorado, Tennessee, New York, and Kentucky have implemented CFRP to assess fatalities among high risk populations. These programs are typically established by state law and carried out at both local and state levels [22]. For example, Kentucky's system is composed of local teams directed by a coroner. State teams exist to provide assistance to local teams, analyze statewide data, and recommend changes in state practices to decrease fatalities [23]. While these reviews include neonatal mortality, they are broader in scope and include all childhood and adolescent mortality. By contrast, Fetal and Infant Mortality Review (FIMR) programs are community-based state initiatives focused on fetal and infant deaths, and therefore, more closely associated with assessing the effectiveness of perinatal regionalization. Currently 220 FIMR programs exist among 40 states [24]. All seven states included in this assessment utilize FIMR programs. These review programs are a valuable source for perinatal statistics and evaluating the need for community-driven risk-appropriate care.

Measuring access to risk-appropriate care by geographic region is an important measure in assessing the effectiveness and catchment areas defined in a perinatal regional system. Previous studies indicate high-risk pregnancy populations living further distances from subspecialty centers are less likely to deliver at appropriate facilities [25, 26]. To address this issue, Florida law requires Level II and Level III neonatal intensive care facilities to be accessible within 2 h drive time for 90% of the population in the region [27]. In some states, such as Arkansas, patient preference to deliver closer to home is a common cause of high-risk deliveries at lower level facilities [14]. Arkansas is considered a rural state and all tertiary care perinatal facilities are located in Little Rock. Other states encounter difficulty in administration of risk-appropriate care in urban areas. Due to highly competitive hospital systems and insurance reimbursements, a Level II facility may be less likely to transfer to an out-of-network Level III.

Consideration of geography aids in allocation of medical facilities and resources in regionalization of care.

Identification of high-risk populations provides an initial step for implementing risk-appropriate care. Tennessee's Department of Health has examined risk factors for VLBW infants. Their study notes increased prevalence of older unmarried mothers delivering VLBW infants [28]. Additionally, race is a frequently cited risk-factor for VLBW infants. Racial disparities have been a long standing issue in regionalization. Both Arkansas and Tennessee experience a disproportionate percentage of VLBW African-American infants delivered at lower level facilities. However, New York has reduced its African-American infant mortality rate through a community based regionalization model. This system establishes a partnership among medical facilities and between healthcare providers. The patient's needs are met through home visits, support services, or appropriate transfers [14]. Demographic assessments identify high-risk populations for re-allocation of state resources.

Actions to Improve Risk-Appropriate Care

States use multiple strategies to address quality improvement in risk-appropriate care. Transfer to appropriate facilities is one such strategy to improve outcomes. High-risk infants delivered at tertiary care centers have less risk for morbidities compared with outborn neonates (neonates transferred after delivery) transferred for appropriate care [29–31]. Although antenatal transport is the preferred method of care for these infants, most states have few or no policies promoting obstetric transport. California has created the California Perinatal Transport System (CPeTS) for the transport of critically ill or high risk infants to neonatal intensive care units (NICU) [32]. In California, incorporation of antenatal transport has been suggested, but no statewide initiative has been implemented. A handful of medical centers now advocate and facilitate maternal transport; however, neonatal transports greatly outweigh maternal transfers. Over 7,000 infants are transported annually, whereas less than 1,000 maternal transports occur [14]. Florida's transportation system is coordinated through the 11 RPICCs and primarily emphasizes neonatal transport. Two RPICCs, however, have developed antenatal transportation systems [33]. In Tennessee's *Guidelines for Transportation* the subcommittee urges use of maternal transport when diagnosis of possible neonatal complications lead to transport of the newborn [34]. All obstetrical hospitals in New York State are required by State regulation to have affiliation agreements with a RPC outlining the parameters for consultation and transport of high risk mothers and neonates [14]. While many states demonstrate

well-established systems for neonatal transport, antenatal systems are less developed.

Telecommunication is another method used to improve patient access to risk-appropriate care. Arkansas has a well-established telemedicine program created for a rural and widely dispersed population [35]. The majority of resources for high-risk pregnancies are concentrated in Little Rock and not easily accessible to all citizens. However, perinatal specialists at the University of Arkansas for Medical Sciences host monthly teleconferences with practitioners from over 25 rural communities. Three days a week, specialists conduct telenursery rounds with large nurseries in the state. This program builds rapport between physicians and promotes consultations [36]. Subsequent transport to appropriate facilities has increased. A study of Arkansas's system reveals presence of a telemedicine site increased the probability of antenatal transport to a level III facility [37]. Additionally, the state of Florida intends to use telemedicine as a mechanism to disseminate resources to a greater population [14]. Telemedicine has proven a useful tool for increasing access to risk-appropriate care.

Maintenance of funding is essential for sustainability of perinatal regionalized systems. Need for appropriate funding is noted in current research and was frequently cited as a necessity for quality improvement projects at the AMCHP meeting [14]. A common source of federal funding targeting services for women, infants, and children is the Title V Maternal and Child Health Services Block Grant. This money is used to finance regionalization projects and programs such as FIMR [38]. State funding varies according to state budget and priorities for perinatal care. Hospitals aid efforts by funding patient education and transportation programs. Lack of funds and state budget cuts are devastating to these programs. Multiple state presentations at the AMCHP meeting referenced budget cuts as a barrier to improvements in risk-appropriate care [14]. Without proper funding, long-term sustainability of a comprehensive system of perinatal regionalization would be difficult for any state or region.

Financial incentives also reinforce regionalization efforts. For example, New York State provides grants ranging from \$100,000 to \$400,000 to RPC to support regionalization activities. The allocation of money is based upon number of births within the network [14]. Medicaid reimbursements are state dependent and another way of providing financial incentives. In Florida the RPICC program is paid an enhanced Medicaid fee for high-risk patients. Kentucky's Medicaid reimbursements are based upon level of care with higher amounts allocated to level III centers. Monetary incentives provide motivation for hospitals and providers to comply with regionalization guidelines.

Patient education and public awareness are key components to improving access to risk-appropriate care. A high-risk pregnancy can be a highly stressful experience for a mother. She may feel removed from the decision making process and helpless if quickly transferred to a higher level facility without explanation. Alternatively, feelings of guilt may arise if a high-risk patient delivers at a lower level facility without knowledge of its capabilities. New York mandates that all perinatal facilities distribute a maternity information leaflet to each prospective maternity patient that includes a brief definition of the Level designation [15]. Patient education and public support is a necessary component for state adherence to regionalization guidelines.

Further Considerations and Need for Dialogue

Much has changed in the field of neonatology since the initial *TIOP I* guidelines were released in 1976. Technological advances such as surfactant therapy and antenatal steroids have led to improved survival of VLBW infants and are widely available. An increase in the number of licensed neonatologists has led to increased specialists at lower level facilities [39]. Additionally, the rise of managed care organizations and variations in provision of insurance restricts access to some hospitals in specific catchment areas. As hospitals become more competitive in advertising and expansion of services, patients may elect to receive care at more publicized facilities rather than examining care designation levels. These changes in access to care along with varied interpretations of current definitions support the need for re-evaluation of current measures.

March of Dimes intends to release the third volume of *Toward Improving the Outcome of Pregnancy* by the end of 2010. The report will focus on opportunities to enhance perinatal health throughout the entire spectrum of perinatal care, including opportunities to reduce disparities in perinatal health outcomes [40]. Also the US Department of Health and Human Services (DHHS) will release objectives for Healthy People 2020 this year. Each Healthy People 2020 objective is required to produce "valid, reliable, nationally representative data" [41]. The objectives related to risk-appropriate care for high-risk pregnancies include: "Increase the proportion of pregnant women who receive early and adequate prenatal care", "reduce low birth weight and very low birth weight deliveries", and "reduce preterm births" [41]. However, none of the objectives directly measure access to risk-appropriate care at time of delivery.

One proposed measure for risk-appropriate care is based upon facility volume of VLBW infants treated. A prior study noted increased VLBW survival in facilities with higher volume VLBW infants [11]. However, the study took place in an urban area where many hospitals had over 100

deliveries. Difficulty arises in application to rural regions since patient volume, and therefore volume of VLBW deliveries, is often lower in these states. Current research efforts in Georgia to classify hospitals according to percentiles for volume of VLBW infants are underway. Hospitals which had more than 25 births weighing less than 1,250 g (above the eightieth percentile) had the lowest neonatal mortality and were classified as high volume facilities. Hospitals with a volume of less than 15 births (less than 1,250 g) demonstrated the greatest neonatal mortality [42]. Plans to reproduce this work in other Southeastern states are planned by researchers in Georgia. Volume based measurements may prove to be beneficial for rural areas and may contribute to a standard measure for all types of areas in states.

This review of regionalized systems for the seven participating states highlights the need for further study of risk-appropriate care in varying settings. In order for state measures of risk-appropriate care to be comparable, use of surveillance systems in addition to vital records must be adopted, so that numerous aspects of quality and implementation can be assessed. Individual state characteristics and structure help determine the regionalization model. While state-specific issues intrinsically lead to variations in perinatal programs, standard definitions are necessary for evaluation of program efficacy. Definitions must be constructed that include a consistent framework while taking into account variation in state needs, resources, and hospital systems. These definitions would provide national accrediting organizations a mechanism for regulating national standards. Cross comparison of state programs would be more accurate and allow for the establishment of evidence-based approaches to administering care among high-risk populations. Examination of the varying systems provided in this paper suggests the need for standardized measurement of risk-appropriate care, and further study of the underlying mechanisms for regionalized systems.

Conclusion

State models of regionalized risk-appropriate care vary. Due to these discrepancies, national attempts to compare access to risk-appropriate perinatal care, and establish the evidence base for effectiveness, have been difficult to achieve. This impacts efforts to optimize VLBW infant access to appropriate facilities, a worthwhile endeavor as this population comprises a majority of neonatal deaths [7, 8]. State legislatures, regulatory institutions, public health officials, and hospitals themselves must recognize and commit to the need for national standards and definitions, determine what these standards will be, and disseminate this information to healthcare providers, clinicians, and patients.

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