Maternity Units in Rural Hospitals in North Carolina: Successful Models for Staffing and Structure

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Objectives: Almost 15% of all US births occur in rural hospitals, yet rural hospitals are closing at an alarming rate because of shortages of delivering clinicians, nurses, and anesthesia support. We describe maternity staffing patterns in successful rural hospitals across North Carolina.

Methods: All of the hospitals in the state with ≤200 beds and active maternity units were surveyed. Hospitals were categorized into three sizes: critical access hospitals (CAHs) had ≤25 acute staffed hospital beds, small rural hospitals had ≤100 beds without being defined as CAHs, and intermediate rural hospitals had 101 to 200 beds. Qualitative data were collected at a selection of study hospitals during site visits. Eighteen hospitals were surveyed. Site visits were completed at 8 of the surveyed hospitals.

Results: Nurses in CAHs were more likely to float to other units when Labor and Delivery did not have patients and nursing management was more likely to assist on Labor and Delivery when patient census was high. Anesthesia staffing patterns varied but certified nurse anesthetists were highly used. CAHs were almost twice as likely to accept patients choosing a trial of labor after cesarean section (CS) than larger hospitals, but CS rates were similar across all hospital types. Hospitals with only obstetricians as delivering providers had the highest CS rate (32%). The types of hospitals with the lowest CS rates were the hospitals with only family physicians (24%) or high proportions of certified nurse midwives (22%).

Conclusions: Innovative staffing models, including family physicians, nurse midwives, and nurse anesthetists, are critical for the survival of rural hospitals that provide vital maternity services in underserved areas.

Key Words: anesthesia, hospitals, maternity care, obstetrics, rural

Maternal morbidity and mortality in the United States has nearly doubled during the past 20 years.[1,2] For women and infants most at risk—Black women, those living in poverty and in underserved and rural areas—the statistics are particularly concerning.[3,4]

Approximately 500,000 women deliver their infants in rural hospitals annually, representing 15% of all US births.[5] More than half of all US hospitals are rural or critical access hospitals (CAHs).[6] Twenty percent of the US population lives in rural areas, yet rural hospitals are closing at an alarming rate and rural maternity care units are struggling to remain viable, a situation resulting in many rural areas where women are forced to travel long distances to seek care and give birth.[7]

The existence of maternity care deserts in rural areas exacerbates existing racial and socioeconomic disparities. Women living in rural areas who are unable to travel to nonrural hospitals have less prenatal care and more preterm births.[3,8] Women living farther away from the hospital are more likely to have elective early-term inductions with subsequent disproportionate elevations in neonatal intensive care unit admissions and maternal and infant morbidity.[9] Overall, rural women have a 9% increased risk for maternal morbidity and mortality compared with urban women,[10] and neonatal mortality rates are at least 8% higher in rural areas. When hospitals are studied, however, there is no discernible difference in the rates of maternal mortality between

Key Points

- Rural maternity care units in small hospitals are closing in the United States at an alarming rate, reducing accessibility and disproportionately increasing the burden of care for women of lower socioeconomic status and women of color.
- To protect existing maternity units and open new rural maternity units, a better understanding of markers of successful service models in maternity care is needed.
- Rural maternity units struggle to manage the extremes in unit census while retaining staff and sustaining training and readiness in low census settings.
- Models of care that included family medicine physicians and certified nurse midwives were found to have lower cesarean section rates than models of care dependent on obstetricians.

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urban and rural hospitals, and neonatal mortality rates for healthy rural women delivering normal-weight newborns is highest in urban hospitals, higher than their urban counterparts.[11] The gap is even wider for rural women of lower socioeconomic status and women of color.[12] When rural hospitals close, rates of out-of-hospital birth, birth at hospitals without obstetric care, and premature births increase.[8]

The reasons cited for rural hospital maternity ward closure include low birth volume, low reimbursement rates, high rates of medical malpractice for obstetricians, and the additional economic pressures of caring for patients who are uninsured or underinsured, particularly in states without Medicaid expansion programs. The other important reasons cited for closure include shortages of delivering clinicians, nurses, and anesthesia support.[13] Physicians, particularly specialists, are increasingly concentrated in metropolitan areas, with only 6% of obstetrician-gynecologists practicing in rural areas. Family physicians practicing obstetrics are more likely to work in rural areas than obstetricians and still provide the majority of maternity care services in many rural and CAHs; however, these rates also are declining.[3,14,15] Any facility offering obstetric services should have the ability to perform a cesarean section (CS) within 30 minutes of deciding that this is necessary.[16] The continuous (24 hours per day/7 days per week) anesthesia and surgical support necessary to accomplish this can be difficult for rural hospitals to sustain.

Obstetric nursing roles in small hospitals also can be challenging. Two registered nurses (RNs) are required to be available at all times, yet staffing must be flexible enough to support hospital needs when the census is low and increase to manage high patient volumes.[17,18]

Sustaining high-quality rural maternity care is critical to reducing maternal and infant health disparities. A better understanding of successful staffing models of rural hospitals is essential in preventing more closures.[17,19] We sought to explore current staffing trends in rural North Carolina hospitals that have been able to keep their maternity units open to inform our own efforts at opening a maternity unit in a North Carolina CAH. Our overarching goal in collecting primary data for this study was to quantitatively and qualitatively describe features of successful maternity units and to glean insights into common challenges such as volume and staffing.

Methods

Our population consisted of hospitals located outside of metropolitan areas, actively providing maternity care in North Carolina, and with <200 acute staffed hospital beds.[20] Hospitals with maternity units were identified for participation by reviewing the American Hospital Association's 2019 report for active labor and delivery beds[21] and cross-checking for actively licensed maternity care providers using publicly available North Carolina License Renewal Application data from 2019 (reporting period October 1, 2017–September 30, 2018).[22]

We used primary and secondary data to describe small rural maternity units. Secondary state-level data from the American Hospital Association provided the number of acute staffed beds, licensed delivery rooms, and birth and CS rates. Primary data were collected using surveys and site visits. The research team, including two of the authors, administered a telephone survey to all eligible hospitals between August and December 2018, following standard questions adapted from the work of Kozhimannil et al on the layout, staffing, and function of obstetric units.[23] Surveys were tested for feasibility and length by a convenience sample of family physicians with expertise in rural and/or maternity care, and included questions on surgical and anesthesia coverage, risk and transfer protocols, and staffing for nursing, anesthesia, delivering providers, newborn care, and ancillary staff. A site visit and 2-hour interview was administered to a sample of the study hospitals between March and December 2019. Selected hospitals included two hospitals each from the coastal, eastern, central, and mountain regions of North Carolina. Site visits added qualitative data on physical layout and patient flow, as well as identified innovative models of care.

Statistical Analysis

Hospitals were categorized into three types: CAHs, designated as such by the Centers for Medicare & Medicaid Services,[24] small rural hospitals (SRHs), and intermediate rural hospitals (IRHs). CAHs by definition have ≤25 acute care beds, are located in rural areas more than a 35-mi drive from any other hospital, and provide emergency services 24 hours per day, 7 days per week. SRHs are defined as those having ≤100 acute staffed hospital beds without being defined as CAHs, and IRHs as having >100 and up to and inclusive of 200 acute staffed hospital beds.

Hospitals in our study population were described overall by category, using frequencies and means. Staffing on rural maternity units was examined by the type of provider performing deliveries, makeup of surgical teams performing CSs, and CS rates by type of provider. All of the descriptive analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC).

Responses to open-ended questions from each of the eight hospitals that received site visits were tabulated and thematically coded. Where possible, the frequency of responses within hospital categories was noted. The institutional review board of the University of North Carolina at Chapel Hill reviewed the study and determined it exempt.

Results

In 2018, North Carolina had 125 hospitals and 118,957 births. Of these hospitals, 79 provided maternity care and 53 met our size criteria for study inclusion. Among the hospitals that met our size criteria, 20 also were in nonmetropolitan locations. Two hospitals were excluded from the study as a result of the closure of their maternity units in 2019, leaving 18 hospitals in our final study sample. The final study sample included 4 CAHs, 9 SRHs, and 5 IRHs, at which 7769 live births occurred (6.5% of North Carolina births).

Hospital Characteristics

Descriptive characteristics of hospitals by category are presented in the Table. The volume of Medicaid status (mean 15%–18%) was similar across all of the hospital types. Hospital catchment areas included travel times for laboring women as long as 2 hours at o1ne remote CAH, with most reporting approximately 45 to 60 minutes.

SRHs and IRHs had almost twice as many delivery beds per unit, but the number of deliveries per bed was relatively similar across all categories of hospital. Delivering providers at CAHs perform many more deliveries than providers at SRHs and IRHs (103 births vs 93 at SRHs and 59 at IRHs), but nurses at CAHs have approximately half as many deliveries per full-time equivalent than do nurses at SRH and IRH hospitals (21 births vs 47 at SRHs and 44 at IRHs).

General Staffing Models

Within North Carolina rural hospitals, deliveries were being attended by obstetricians, Family Medicine physicians (FM), FM physicians who also performed CSs (FM-S), and certified nurse midwives (CNMs). None of the CAHs had CNMs but they were the most likely to have FM-S physicians. In fact, one hospital had only FM-S physicians on staff (backed up by general surgeons). CNMs were most likely to be found in SRHs (Fig. 1).

Table. Characteristics of surveyed rural hospitals in North Carolina with maternity units by hospital category

	Overall	CAH	SRH	IRH
No. hospitals	N = 18	n = 4	n = 9	n = 5
Total no. births	N = 7769	n = 924	n = 4438	n = 2407
			Mean	
Days of care: Medicaid, %	15	13	16	15
Earliest gestation accepted (n = median wk)	35	35	35	34
Allow TOLAC, %	44	75	33	40
Total CS rate, %	29	28	28	30
Deliveries				
Births per staffed delivery beds (n = births)	64	66	60	73
Births per delivering provider (n = births)	79	103	92	59
Births per nursing FTE (n = births)	40	21	47	44
LDR and LDRP beds (n = beds)	7	4	8	7
Other providers and staff				
Nurse (n = FTE)	13	11	13	14
Nurses float to other units, %	56	75	56	40
Pediatricians providing newborn care, %	83	75	78	100
Family physicians providing newborn care, %	56	50	44	80
Advanced practice nurse providing newborn care, %	11	25	11	0
Lactation consultant on staff, %	50	75	33	60

LDR and LDRP are types of delivering rooms, including postpartum care (LDRP) or only labor, delivery, and recovery (LDR). CAH, critical access hospital; CS, cesarean section; FTE, full-time equivalent; IRH, intermediate rural hospital; SRH, small rural hospital; TOLAC, trial of labor after CS.

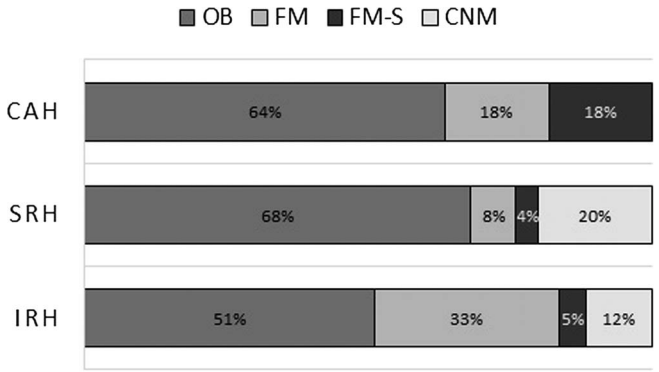

Fig. 1. Frequency of total type of delivering providers on staff for critical access hospitals (CAHs), small rural hospitals (SRHs), and intermediate rural hospitals (IRHs) in North Carolina, 2018. Types of providers include obstetricians (OB), Family Medicine physician performing deliveries (FM), Family Medicine physician performing cesarean sections (FM-S), and certified nurse midwife performing deliveries (CNM).

CS Rates and Staffing

CAHs were almost twice as likely to accept patients choosing a trial of labor after CS than larger hospitals, but CS rates were similar across all hospital types. Hospitals with only obstetricians as delivering providers had the highest CS rate. The types of hospitals with the lowest CS rates were the hospitals with only FM physicians or high proportions of CNMs (Fig. 2).

All of the hospitals used certified registered nurse anesthetists (CRNAs) for labor analgesia and CS, whereas some additionally had anesthesiologists. When the anesthesiologist was the primary anesthetist, he or she was in the hospital during the day and called in nights and weekends. Among hospitals with CRNAs, only one IRH had a CRNA in the hospital at all times. In all of the others, the schedule was similar to the anesthesiologist's schedule. Almost all of the CAHs (three of four) and one SRH used a nonanesthesiologist physician on site to supervise the CRNAs providing anesthesia (either FM-S, obstetrician, or general surgeon). All of the hospitals surveyed offered epidurals for labor analgesia at all times and one CAH also offered nitrous oxide. During site visits, three hospitals (one CAH and two SRHs) defined surgical responses in stages that included urgent (readiness for a CS in 30 minutes) versus a routine or nonurgent designation (readiness for CS in 60–90 minutes).

Three of the four CAHs surveyed exclusively used operating room (OR) staff to scrub and circulate for maternity patients. In SRHs and IRHs the models were evenly divided between using OR or Labor and Delivery staff, with only one hospital using a scrub technician from the maternity care unit (Fig. 3).

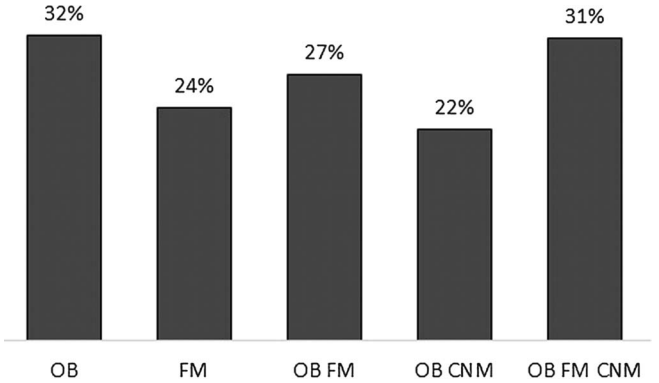

Fig. 2. Cesarean section rate (frequency of births that are cesarean sections out of the total number of births) by type of provider within all rural hospitals in North Carolina, 2018. Types of providers were divided into obstetricians (OB), Family Medicine physicians (FM), or a combination of OBs, FMs, and certified nurse midwives (CNM).

Nursery Space and Newborn Care Staffing

All of the hospitals surveyed used mother–baby nursing, in which one nurse cared for the mother and baby in the mother's room, and during site visits the nursery space was seen to largely be used to store equipment and occasionally for minor procedures, including circumcisions or line placement. Most hospitals had both FM physicians and pediatricians providing newborn care. FM physicians were more likely to provide newborn care in IRHs. During the site visits, respondents from three hospitals mentioned the need for additional resources and training to respond to neonatal abstinence syndrome resulting from maternal substance use.

Emergency Preparedness

All of the hospitals included in site visits had some version of emergency kits or carts readily available in the maternity unit (including postpartum hemorrhage and neonatal resuscitation kits; one SRH had a separate preeclampsia kit) and all scheduled regular skill drills for emergencies, which included delivering providers, nurses, and sometimes emergency room staff. Two of the CAHs and one SRHs connected to a larger healthcare system had regular webinars for nurses to help them stay connected and informed. All of the hospitals of all types had access to whole blood and packed red blood cells, and three had cryoprecipitate, but only one IRH hospital had continuous access to platelets for transfusion.

Nursing Staff and Breastfeeding Support

In three of the four CAHs and in all of the SRHs and IRHs, if the maternity census was low, nurses floated to other units, but during site visits we found only one hospital that had nurses accept a primary patient assignment when they were floating. Other low-census tasks for nurses included making postpartum telephone calls or answering a "mama hotline" (three hospitals); peer chart review audits; "preadmission" orientation sessions in the third trimester; and community engagement work, including building relationships with local health departments and providing community education classes, health fairs, and other community events. Conversely, when the unit was busy, nurses in management had various levels of involvement in staffing, up to and including taking on patient care.

Three of the CAHs and one SRH had received the "Baby-Friendly" designation and half of the hospitals had designated lactation support.[25] CAHs were the most likely hospitals to include lactation consulting services (75%), but overall, three units had recently lost lactation consultants and were operating without this support.

Hiring and retaining nurses was a concern noted by most nursing leaders during site visits. Local nurses were preferred over new nursing graduates or traveling nurses, although hiring new graduates could not always be avoided. One hospital found that their best nurses were those whom they trained from early in their careers. More than half of the hospitals included in the site visits had connections with local nursing schools.

Marketing and Community Engagement

During site visits, the survey team elicited discussion about marketing to the community and why small rural hospitals were chosen over larger hospitals. None of the hospitals were able to provide a clear vision or mission statement about their maternity care services, despite expressing the importance of maternity care to the hospital's reputation and desire to serve the local community. Only half of the hospitals surveyed had a patient advisory board. When asked why they thought women chose their local maternity services, participants reported their patients trusted the quality of their care and perceived it as friendly, personal, and convenient. When asked why women from the area electively delivered elsewhere, there were a variety of responses, including outdated physical architecture of Labor and Delivery

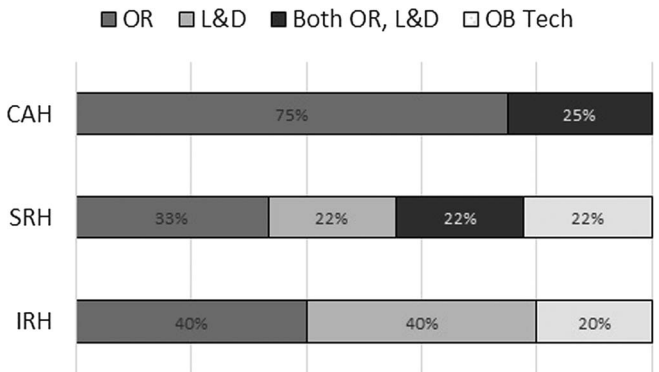

Fig. 3. Frequency of model used for staffing on cesarean section cases for CAHs, SRHs, and IRHs in North Carolina, 2018. Scrubbing on cesarean sections performed by OR (general operating room staff), L&D (nursing staff from Labor and Delivery unit), Both OR, L&D (mixed model using both Labor and Delivery staff as well as general operating room staff), or OB Tech (scrub technician from the Labor and Delivery unit).

units, desire for midwifery care, or a higher level of neonatal emergency care. More than half of the hospitals stated that the best marketing for their maternity unit was word of mouth, primarily including the fact that local nurses and staff themselves delivered at the hospital. All of the respondents mentioned that it was very important to have a strong relationship with the local health department. Many of the hospitals had community education classes for childbirth, breastfeeding, and perinatal depression. Usually these were provided through contracts with community educators rather than by hospital nursing staff.

Discussion

Our study illustrates the range of models used in rural maternity care hospitals to balance the need for minimal staffing during low-census times, while also being flexible enough to provide critical staffing for higher volumes and maternal or neonatal emergencies, including emergency CS delivery.

CAH hospitals are at particular risk for staffing challenges, as can be seen in their low delivery per nurse full-time equivalent, the result of regulation staffing requiring the availability of two Labor and Delivery RNs at all times. CAHs as well as SRHs consistently expected maternity nurses to float to other hospital units during times of low census or to have alternate uses for maternity beds, including surgical patients' recovery on Labor and Delivery during low-census days. Conversely, adding nursing staff to Labor and Delivery from other units on high-census days is difficult because of the lack of maternity care training.

Provisions for surgical staffing requires CAHs to embrace flexibility to maintain maternity services and surgical care overall. The proximity of the OR to the Labor and Delivery unit seemed to determine whether OR nurses or Labor and Delivery nurses circulated for CS because Labor and Delivery nurses had to stay available to their unit. In North Carolina, CRNAs must have an on-site supervising physician to provide anesthesia, whereas analgesia for labor (including epidural) can be performed independently. Low patient volumes make hiring anesthesiologists difficult or financially improbable, particularly for small hospitals not connected to larger healthcare systems.[26] A large minority of hospitals had an anesthesiologist on call, but it was unclear how often anesthesiologists, as opposed to CRNAs, were called in. A few of the hospitals reported plans for or recent changes to the use of CRNAs in place of anesthesiologists.

Our survey found that more than half of the delivering providers at small hospitals were obstetricians, whereas only four hospitals included FM-Ss and six included CNMs, suggesting that CNMs and FMs, particularly FM-Ss, are an underused resource in North Carolina. Obstetricians leaving rural hospitals has been a driving force in hospital closures. Although these hospitals may not have the patient load and complexity that OBs are prepared to care for, they have sufficient patients to support the work of an FM physician practicing obstetrics as part of his or her full-scope primary care, which may, with the addition of CNMs, lower overall CS rates.

Our study population is relatively limited in size. Although it did include all CAHs, SRHs, and IRHs with current maternity care units in North Carolina during the study period, the births only represent 6.5% of the births in the state; therefore, the size and scope of the study population increase the chances that some of our findings are the result of individual hospital cultures rather than patterns associated with hospital size. Across the hospitals we studied, there were occasions when the models of care required the pooling of data that in a larger sample may have been isolated. Future work using larger samples across state lines may allow for the differentiation of specific models of care.

Annual deliveries were used as a proxy for patient census, which was too various to be useful in calculations, as hospitals with higher rates of CSs or preterm deliveries may have more inpatient days of care, even with the same number of deliveries.

Conclusions

Traveling long distances for maternity care increases the risk for complications, which deepens inequities in mortality rates; therefore, sustaining rural maternity care units is critical. Many rural maternity units are struggling to stay afloat, and yet women in the United States depend on the services of local hospitals for maternity care. Hospital personnel in these settings take on multiple roles to maintain the flexibility needed to balance efficiency and readiness across nursing, anesthesia, and delivering providers. These conditions underscore the need for supportive infrastructure and a diverse range of committed and well-trained providers. FM physicians fill this need by providing a broad range of skills that can be applied across departments. Including CNMs and CRNAs can reduce costs while maintaining high-quality care. As small rural hospitals develop new and innovative models of care, evaluating and disseminating their outcomes presents an important area of research.

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