OBSTETRICS

Location of childbirth for rural women: implications for maternal levels of care

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BACKGROUND: A recent American Congress of Obstetricians and Gynecologists and Society for Maternal-Fetal Medicine (MFM) consensus statement on levels of maternity care lays out designations that correspond to specific capacities available in facilities that provide obstetric care. Pregnant women in rural and remote areas receive particular attention in discussions of regionalization and levels of care, owing to the challenges in assuring local access to high-acuity services when necessary. Currently, approximately half a million rural women give birth each year in US hospitals, and whether and which of these women give birth locally is crucial for successfully operationalizing maternal levels of care.

OBJECTIVE: We sought to characterize rural women who give birth in nonlocal hospitals and measure local hospital characteristics and maternal diagnoses present at childbirth that are associated with nonlocal childbirth.

STUDY DESIGN: This was a repeat cross-sectional analysis of administrative hospital discharge data for all births to rural women in 9 states in 2010 and 2012. Multivariate logistic regression models were used to predict the odds of childbirth in a nonlocal hospital (at least 30 road miles from the patient's residence). We examined patient age, race/ethnicity, payer, rurality, clinical diagnoses (diabetes, hypertension, hemorrhage during pregnancy, placental abnormalities, malpresentation, multiple gestation, preterm delivery, prior cesarean delivery, and a composite of diagnoses that may require MFM consultation), as well as local hospital characteristics (birth volume, neonatal care level, ownership, accreditation, and system affiliation).

RESULTS: The rate of nonlocal childbirth among 216,076 rural women was 25.4%. It varied significantly by primary payer (adjusted odds ratio [AOR], 0.76; 95% confidence interval [CI], 0.68—0.86 for Medicaid vs private insurance) and by clinical conditions including multiple gestation (AOR, 1.82; 95% CI, 1.58—2.1), preterm deliveries (AOR, 2.41; 95% CI, 2.17—2.67), and conditions that may require MFM services or consultation (AOR, 1.28; 95% CI, 1.22—1.35). Rural women whose local hospital did not have a neonatal intensive or intermediate care unit had nearly double the odds of giving birth at a nonlocal hospital (AOR, 1.94; 95% CI, 1.64—2.31).

CONCLUSION: Approximately 75% of rural women gave birth at local hospitals; rural women with preterm births and clinical complications, as well as those without local access to higher-acuity neonatal care, were more likely to give birth in nonlocal hospitals. However, after controlling for clinical complications, rural Medicaid beneficiaries were less likely to give birth at nonlocal hospitals, implying a potential access challenge for this population.

Key words: hospital care, maternal complications, preterm birth, rural obstetrics

Introduction

The movement toward regionalization of perinatal care began in the 1970s, with a focus on developing coordinated referral systems to ensure access to facilities with adequate levels of care.[1,2] Pregnant women in rural and remote areas receive particular attention in discussions of regionalization, owing to the challenges in assuring local access to high-acuity services when necessary.[3-6]

Currently, approximately half a million rural women give birth each year in US hospitals. Compared with women in urban areas, rural women experience poorer health outcomes and have less access to health care, both generally and with respect to obstetric services.[7] In rural areas, women must travel greater distances to access hospitals with perinatal care—particularly those offering higher acuity neonatal care services—than in urban areas.[8] Many rural women with low-risk pregnancies can safely give birth at local hospitals, a choice that helps to minimize the additional perinatal morbidity risk of increased travel distance[8,9]; however, complications that necessitate higher-acuity care (eg, placenta previa, preeclampsia/eclampsia, cardiac conditions) happen frequently in obstetrics, even among low-risk pregnancies.[10] The challenge of ensuring that appropriate maternity services are available to meet clinical needs tops the list of concerns among rural obstetric unit managers, medical directors, and clinicians.[11]

The recent consensus statement from the American Congress of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine (MFM),[12] documenting uniform designations for levels of maternity care, begins to address this challenge by encouraging clarity around the specific capacities available in different facilities that provide obstetric care. This consensus statement marks the first coordinated effort to address the need for appropriate triage of pregnant women, with particular health conditions, to settings where their clinical needs can be met and the best possible outcomes achieved. However, the extent to which rural pregnant women give birth locally or at nonlocal hospitals is not well characterized in the current context. Clinicians and hospital administrators need basic information

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about the rural women who give birth at nonlocal hospitals, as well as the hospitals they leave behind, to effectively operationalize maternity care—level designations in both rural and urban areas.[13] The goal of this study was to measure whether local hospital characteristics or maternal diagnoses present at childbirth were associated with delivery in a nonlocal hospital among rural women.

Materials and Methods

Data sources

We used 2010 and 2012 hospital discharge data from the Statewide Inpatient Databases of the Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality (AHRQ), for 9 states (Colorado, Iowa, Kentucky, New York, North Carolina, Oregon, Vermont, Washington, and Wisconsin).[14,15] The Statewide Inpatient Databases contains 100% of hospital discharge records for all payers within the state in a given year. These states were chosen based on the size of their rural populations, US regional distribution, and because they permit use of patient ZIP codes and linkage with data on hospital characteristics from the American Hospital Association (AHA) annual surveys.[16] Patient-level variables in this analysis were defined by *International Classification of Diseases, Ninth Revision* (*ICD-9*) diagnosis and procedure codes or by Clinical Classification Software codes (AHRQ, Rockville, MD), based on *ICD-9* codes and developed and designed for use with Healthcare Cost and Utilization Project data.

For this study we examined the hospital discharge records of maternal childbirth hospitalizations for rural residents. We identified maternal childbirth hospitalizations using a validated methodology based on *ICD-9* diagnosis and procedure codes as well as Diagnosis-Related Group codes.[17,18] Using federal Office of Management and Budget definitions of rurality, we identified rural women based on their residence ZIP code location in a micropolitan county with at least 10,000 but <50,000 population or a noncore county that is not part of a metropolitan or micropolitan area.[19] All rural women who lived in these 9 states, had a childbirth hospitalization in the same states during 2010 or 2012, and were not transferred from a hospital to another hospital were included in the analysis. Women who were transferred from one hospital to another for their childbirth hospitalization (n = 2931) were excluded because transfers generally occur due to emergent clinical needs that occur in the course of clinical care and do not reflect planned decisions on the part of the mother and her clinician (Appendix 1). The final analysis included 111,764 births in 581 hospitals (2010), and 104,312 births in 565 hospitals (2012).

Measurement

Several studies of rural maternity care have used a specific list of high-risk maternal conditions for which consultation with or referral to a MFM specialist is recommended; this list was based on clinical guidelines developed for the Arkansas Antenatal and Neonatal Guidelines, Education and Learning System program.[20-24] We replicated this list as closely as possible, using *ICD-9* diagnosis and procedure codes, and defined a patient as high risk if the discharge record for her childbirth hospitalization contained a diagnosis for a condition for which MFM consultation or referral was recommended.

Maternal medical conditions defined by *ICD-9* diagnosis and procedure codes included in this analysis were gestational diabetes, diabetes mellitus, hypertension, placental complications (placenta previa, placenta accreta), multiple gestation, malpresentation, preterm delivery (delivery <37 weeks' completed gestation), and prior cesarean delivery.

We defined a local hospital as any hospital in the 9 study states that was either (1) the nearest hospital to the patient's residential ZIP code that provides obstetric services (at least 10 births in a given year), regardless of distance; or (2) any hospital within 30 road miles of the patient's ZIP code that provides obstetric services. The 30-mile distance criterion was selected based on prior research on access to perinatal services,[8] and sensitivity analyses were robust to alternate specifications using a range of distance cut-off values (15-60 miles). We calculated the driving distance from the rural patient's residential ZIP code to the ZIP code of the hospital where she gave birth, and compared it to the distance between the patient's ZIP code and each local hospital(s). Driving distances were calculated based on ZIP code centroids using software (SAS, Version 9.3; SAS Institute Inc, Cary, NC) URL access method linked to Google Maps (Google, Inc., Mountain View, CA); in mountainous areas where Google Maps could not calculate distances, they were calculated using latitude and longitude estimates.[25,26]

Data on hospital ownership, accreditation by the Joint Commission or American Osteopathic Association, system affiliation, and the presence of a neonatal intensive care unit (NICU) or neonatal intermediate care unit (NINT) were from the AHA annual survey. In this survey, a NICU is defined as a unit that must be separate from the newborn nursery providing intensive care to all sick infants including those with the very lowest birthweights (<1500 g). NICUs must also have potential for providing mechanical ventilation, neonatal surgery, and special care for the sickest infants born in the hospital or transferred from another institution, and a full-time neonatologist must serve as medical director. NINTs must be separate from the normal newborn nursery and provide intermediate and/or recovery care and some specialized services, including immediate resuscitation, intravenous therapy, and capacity for prolonged oxygen therapy and monitoring. Using the complete records of hospital discharge data, we calculated annual hospital-level birth volume for each hospital in the analysis.

Analysis

This study used descriptive statistics and multivariate logistic regression models to analyze the chances that a rural woman would give birth in a nonlocal hospital, by maternal sociodemographic characteristics (age, primary payer, race/ethnicity, and rurality of residence), patient clinical diagnoses, and local hospital characteristics. These analyses were conducted with the childbirth