Severe Maternal Morbidity and Hospital Transfer Among Rural Residents

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Key Findings

- Overall, 3.0% of rural residents and 1.6% of urban residents were transferred from one hospital to another during childbirth; among rural residents, 2.0% transferred before childbirth, 0.9% transferred after childbirth, and 0.1% transferred both before and after childbirth.

- Nearly 3/4 (74.2%) of rural residents who were transferred after childbirth gave birth at rural hospitals; this represents approximately 750 rural residents annually (weighted N = 3,700 annually).

- Hospital transfer is rare; almost all rural residents with severe maternal morbidity and mortality (SMMM) (91.8%) were not transferred at all.

- More than 3/4 (84.1%) of rural residents with SMMM who are transferred after childbirth delivered their infants at rural hospitals; this represents 30 rural residents annually (weighted N = 145 annually).

- More than 2/3 (68.7%) of rural residents with SMMM who are not transferred delivered their infants at rural hospitals; this represents approximately 1,000 rural residents annually (weighted N = 5,000 annually).

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Purpose

The focus of this analysis is on rural residents who give birth. In this brief, we compare hospital transfer rates for rural and urban residents who give birth and we provide descriptive information about the relationship between transfer status and severe maternal morbidity and mortality (SMMM) for rural residents in a national sample of hospital discharge data on births that occurred 2008-2014.

Background and Policy Context

Rural residents often travel farther to access medical care, especially obstetric care, and are more likely be uninsured or underinsured than urban residents.[1] Infant mortality and maternal morbidity and mortality are higher in rural versus urban settings.[2,3] Also, access to obstetric care is declining in rural areas. From 2004 to 2014, 179 rural US counties lost hospital-based obstetric services. Loss of these services in rural counties not adjacent to urban areas was associated with increases in out-of-hospital births, births in hospitals without obstetric units, and preterm birth rates.[4] Hospital obstetric units that closed tended to be smaller in size and privately owned. Communities that lost hospital-based obstetric care had more low-income and Black residents as well as fewer obstetricians and family physicians. Rural hospitals also reported closing obstetric units due to low volume of deliveries and financial challenges.[5]

In general, rural hospitals face greater workforce challenges. Lower birth volume hospitals (<240 births/year) are more likely to utilize a shared nurse staffing model (vs. dedicated nurses in the labor and delivery unit)[6] and to have family medicine physicians and general surgeons attending deliveries, rather than obstetricians and midwives.[5] Challenges related to recruitment and retention top the concerns listed by rural obstetric unit administrators.[5]

These factors make local childbirth less accessible for rural residents, yet there are challenges related to travel-

ing to give birth, too. A quarter of rural residents give birth at nonlocal (>30 miles from residence) hospitals, and – controlling for health conditions - the likelihood of nonlocal births increases with maternal age and is higher among those who are White or who have private insurance.[7,8] In rural Northern Minnesota, patient anxiety regarding transportation to the hospital increased ten-fold from 1990 to 2016.[9]

The ability to safely transfer rural patients from one hospital to another when appropriate is important, but research on this topic is sparse. Decisions to transfer patients are often tied to conditions or clinical complications that require maternal-fetal medicine services, advanced neonatal care, or consultation not available at some rural hospitals.[7] There is an association between hospital transfer and delays in diagnosis and management of maternal conditions.[10] Hospitals that have intensive care units on-site are better equipped to handle cases of SMMM and shorten the time involved with transfer to intensive care units off-site before, during, and after childbirth.[11] Delays in transfer and referral may increase risk for maternal morbidity and mortality.[10] However, the severity of maternal conditions also initiates the need for transfer, and the lack of research on these cases makes it difficult to disentangle cause and effect.[10]

While regionalization and maternal levels of care are growing in importance,[12] research on the relationship between transfer, delivery hospital location, and SMMM for rural residents is needed to inform the implementation and refinement of maternal levels of care and to support broad strategies to address rising rates of maternal morbidity and mortality nationally.

Approach

Data for this study came from the National Inpatient Sample (NIS) of the Healthcare and Cost Utilization Project (HCUP),which includes hospital discharge records from all payers. We identified obstetric deliveries using a previously published method.[13] Maternal residency was determined at the county level, based on the Office of Management and Budget (OMB) standard definition of metropolitan statistical areas.[14] Rural counties include those classified by the OMB as non-metropolitan (micropolitan counties - population center of 10,000-50,000 - or non-core counties - population center of fewer than 10,000 people). This analysis focused on rural residents, but also included

urban (metropolitan) residents for some comparisons.

Hospital transfer status was measured as not transferred during the childbirth hospitalization, transferred after hospital admission but before childbirth only, transferred after childbirth only, and transferred both before and after childbirth. Transfer before childbirth into the hospital where the childbirth occurred was identified using the admission source on the patient's discharge record. Transfer after childbirth out of the hospital where the childbirth occurred was identified from the disposition of the patient at discharge as noted on the patient's discharge record. Transfer included transfer from or to a different acute care hospital or from or to another type of health facility. Those with transfers both before and after childbirth likely indicate transfers to higher acuity facilities at each transfer point.

SMMM was identified as a composite measure, defined by International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes using a previously validated algorithm.[15,16]

We used data from 2008-2014, prior to the transition from ICD-9 to ICD-10 coding. All results were weighted to allow for national inferences using SAS 9.4 (Cary, NC). Weighted proportions and 95% confidence intervals were calculated for all outcomes.

Results

Transfer before childbirth is more than twice as prevalent for rural residents than urban residents (Figure 1).

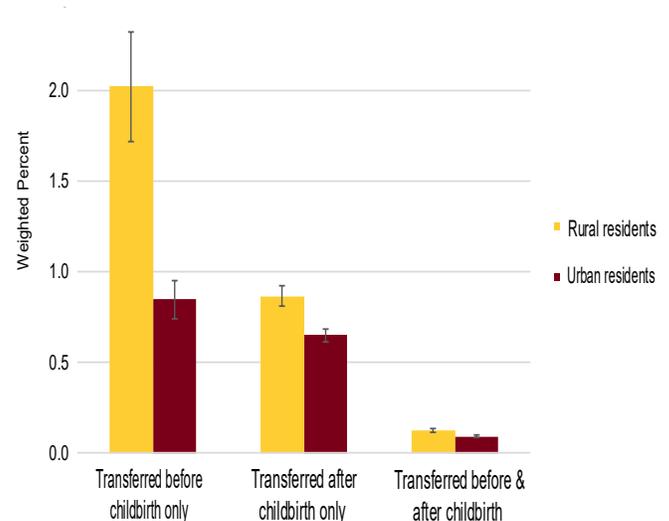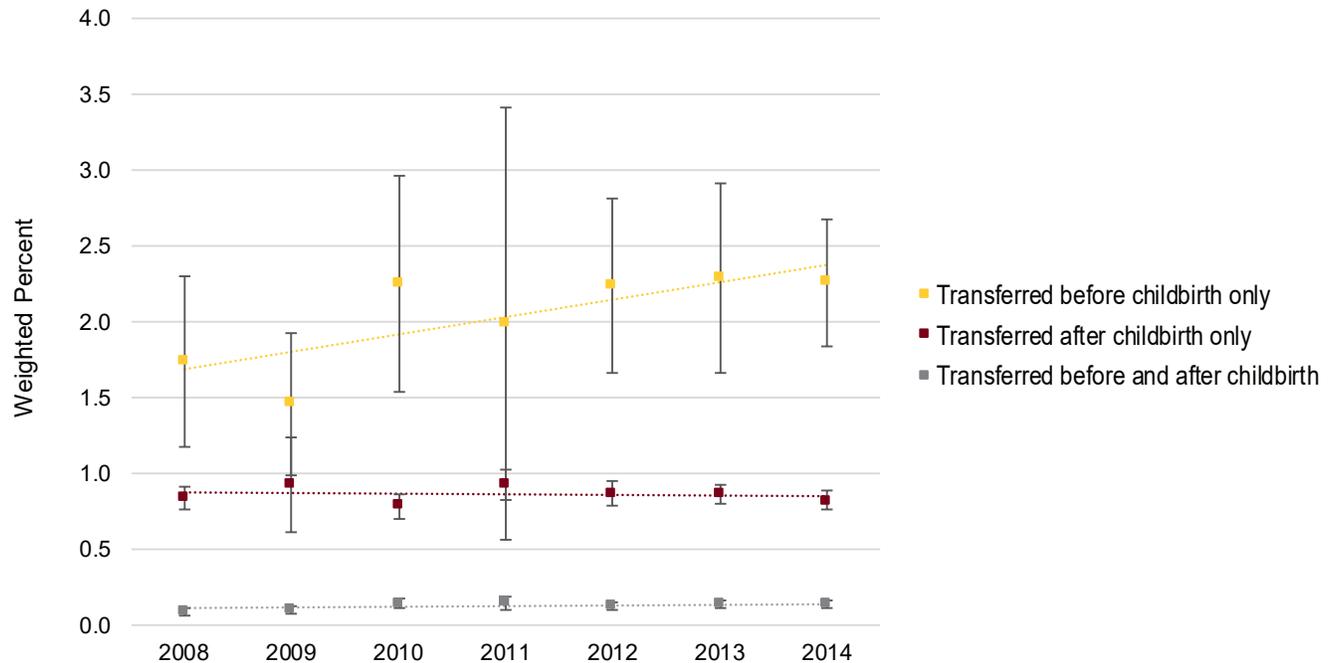**Figure 1: Hospital transfer status among rural and urban residents, 2008-2014**

Figure 2 shows the general rise in rural residents transferred prior to childbirth from 2008 to 2014. Transfer before childbirth is twice as prevalent as transfer after childbirth for rural residents, and it increased over time, while transfers after childbirth, and transfer both before and after childbirth remained

their infants at rural hospitals. The rate of SMMM among rural residents who give birth at rural hospitals and are transferred after childbirth is approximately 1/5 (2,015/10,000 births).

Figure 2. Hospital transfer status among rural residents by year, 2008-2014
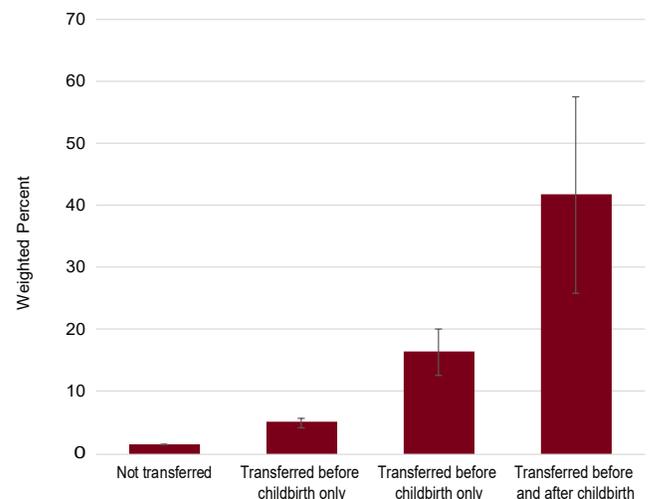

stable. The weighted percent of rural residents transferred increased from 2.7 to 3.2 over the 7-year period.

As shown in Figure 3, SMMM is much more prevalent among rural rural residents who gave birth and were transferred before childbirth (4.8/10,000), transferred after childbirth (16.3/10,000) or both (41.7/10,000), compared with those who are not transferred (1.3/10,000). Nearly 3/4 (74.2%) of rural residents who are transferred after childbirth deliver at rural hospitals. Of the rural residents who are transferred prior to giving birth, almost 7/10 (69.4%) delivered their babies at urban hospitals (Figure 4, next page).

Hospital transfer is rare; almost all rural residents with SMMM (91.8%) are not transferred at all. More than 3/4 (84.1%) of rural residents with SMMM who are transferred after childbirth delivered their infants at rural hospitals. More than 2/3 (68.7%) of rural residents with SMMM who are not transferred delivered

Figure 3. Severe maternal morbidity and mortality among rural residents by hospital transfer status, 2008-2014

Discussion and Implications

Key findings

Overall, transfers are uncommon: 3.0% of rural residents and 1.6% of urban residents were transferred before or after childbirth. There was an increase in transfers before birth, which is associated with better neonatal outcomes than transfers after birth.[17] Yet still, we saw higher rates of transfer over time. We further analyzed transfer rates for rural residents with SMMM. Nearly one in ten (8.3%) rural residents with SMMM was transferred. Most rural residents with SMMM who were transferred after childbirth or who were not transferred delivered their infants at rural hospitals, while the majority who were transferred before childbirth delivered at urban hospitals.

Clinical implications

According to the federal Emergency Medical Treatment and Labor Act, the benefits of transfer must outweigh the potential risks to the patient.[18] While the patient may need a higher level of maternal or neonatal care, the pregnant patient must be stable enough to transfer. Extended travel time to the higher acuity hospital adds inherent risks, and handling complications during transport is challenging. Rural residents often have farther transfer distances and likely have increased inherent risks in cases of transfer.[5]

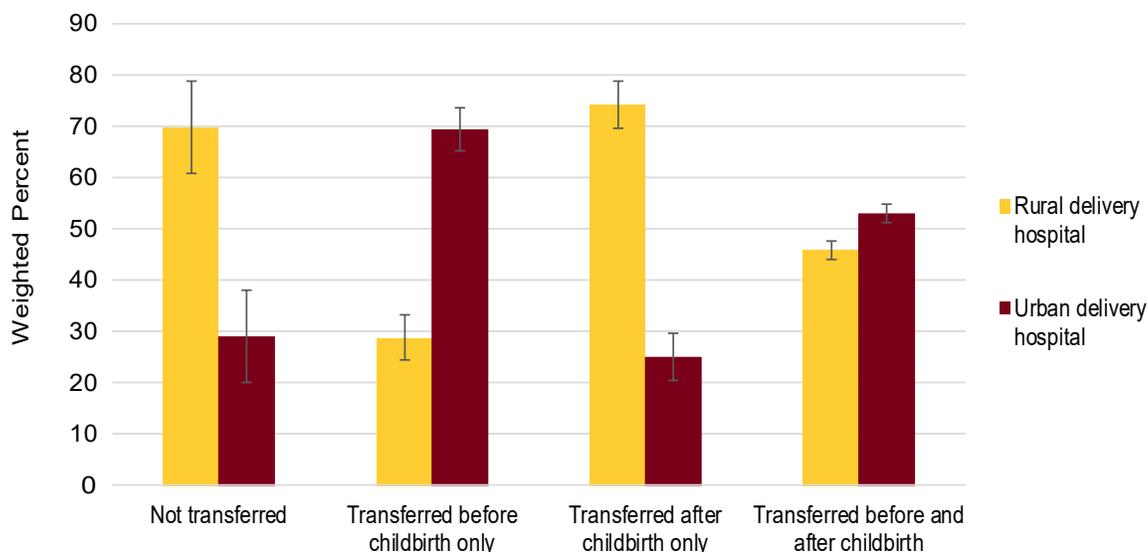The decision to transfer may be for maternal or fetal indications, and occasionally both. For example, transfer may be chosen if extreme preterm birth is anticipated and the hospital does not have a NICU that can provide the necessary level of care. Similarly, if induced or operative birth is anticipated for maternal indications, a more advanced level of maternal care may be needed.[19]

Patients transferred prior to birth are more likely due to fetal or neonatal concerns, while transfers after birth are more likely for maternal indications. Further, maternal transfer after delivery is only paid for by insurance when a higher level of care is needed, not for proximity to their infant. Recent maternal care improvement efforts have focused on development of bundles to implement best practice during high-acuity situations such as hemorrhage and hypertensive emergency, including care "bundles" developed by local and national perinatal care quality organizations. Due to increased obstetric transfers, hospitals may benefit from development and implementation of safety bundles to improve the outcomes of maternal transfers.[22,23] The Association of Women's Health, Obstetric, and Neonatal Nurses' Maternal Fetal Triage Index is a validated tool for obstetric triage.[17,20,21] Hospitals are encouraged to adapt triage protocols to local contexts. These and similar tools may serve as a foundation for the development of validated OB transfer algorithms and best practice bundles.

Policy implications

Greater attention to perinatal regionalization –

Figure 4. Hospital transfer status of rural residents by delivery hospital location, 2008-2014

including Maternal Levels of Care - and support for rural hospitals is needed to support safe maternity care for rural residents, including in the cases where transfer is required. The Maternal Levels of Care designations, first put forth by the American College of Obstetricians and Gynecologists in 2014, were modified in 2019 and strengthened to include more detail on lower levels of care, which tend to concentrate in rural settings.[24] The ideal is to ensure referral to appropriate levels of care, prior to labor and delivery, for rural pregnant patients with high acuity conditions; however, sometimes clinical complexity changes emergently intrapartum, requiring transfer. In these cases, policy guidance and supporting financial policies (including guidance about how to equitably split payments during transfers) is needed. Further efforts to empirically assess the levels of care and to include efforts to measure the role of transfer, could help inform this work. It is possible that the rising rates of transfer before childbirth are indicative of greater proactive use of transfer to appropriate levels of care, and this could be assessed through research.

Further, rising rates of transfer among rural patients indicate a need for simulation, training, and coordination across obstetric sites.[25] Additionally, general maternity care workforce shortages in rural communities place constraints on local capacity as well as on coordination across sites.[26] Efforts to support the clinical training needs and workforce for rural obstetric sites should include attention to the issue of transfer. Inclusion of emergency department and transport services in these efforts will be critical to improving maternal and neonatal outcomes. Support from the regional referral centers, including real time telemedicine consultation, should be incorporated in long-term planning.

Limitations

These data and analyses are subject to several limitations. First, findings reflect diagnoses present at the childbirth hospitalization, and do not include events occurring during pregnancy or after discharge from the delivery hospitalization. Maternal morbidity is much more common than maternal mortality, but maternal mortality is an important focus. Maternal mortality is defined as a pregnancy-related death occurring during pregnancy through one year postpartum,[27] and, as such, our figures underestimate the overall incidence of SMMM by focusing on the childbirth hospitalization, which accounts for approximately 36% of maternal deaths.[25] These data

did not allow us to adjust for maternal comorbidities, such as obesity, which are poorly coded in administrative data. Finally, rural areas are heterogeneous, and this analysis only uses a rough dichotomous measure of residents of non-metropolitan counties.[28] In spite of these limitations, this analysis presents important information regarding the transfer of rural patients around the time of childbirth.

Conclusion

Hospital transfers prior to childbirth are increasing for pregnant rural residents, and patterns of transfer largely indicate transfer of higher risk patients requiring high acuity services to facilities that have this capacity. Continued attention to referral to an appropriate facility during pregnancy, rather than emergent transfer during labor, may help contribute to safe childbirth for all rural patients.

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