Cesarean Section Patterns in Rural Hospitals

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Executive Summary

Childbirth by cesarean section (c-section) is major abdominal surgery that carries risk to both mother and baby. The justification for c-section deliveries includes both medical and non-medical reasons. Once a woman has had one birth by c-section, some obstetricians believe all subsequent births must be performed the same way, but a number of studies show that vaginal births to women with previous deliveries by c-section (VBAC) can be performed safely. This study examines delivery patterns in rural hospitals and compares the c-section rate in rural hospitals to that in urban hospitals. Rates at rural hospitals might differ from rates at urban hospitals if diffusion of innovation such as VBAC is slower in rural areas. Non-medical reasons may also contribute to a higher rate in rural facilities, particularly small hospitals, if lack of surgical coverage on weekends leads to scheduled c-sections in anticipation of problems. Measuring and understanding rural differences in delivery methods is important for monitoring the quality of obstetric care in rural areas and making policy decisions on resources and staffing.

Information about deliveries was obtained for this study from the 2001 Nationwide Inpatient Sample (NIS), a database containing hospital discharge data. Hospitals were characterized as urban (including teaching and non-teaching) and rural. Average daily census (ADC) was used as a proxy for hospital size. All deliveries (denominator) were identified using DRGs 370-375 and cesarean section deliveries (numerator) were identified as those in DRGs 370 and 371. Nationwide

rates were calculated using Stata software that accounts for the complex survey design of the NIS. All rates were weighted and all analyses used proper techniques to generate consistent estimates of standard errors.

Results

Rural hospitals were less likely than urban hospitals to provide any type of delivery services (70% v. 76%). However, smaller rural hospitals were much more likely to provide delivery services than were their smaller urban counterparts.

Overall c-section rates were higher, though only slightly, in rural hospitals compared to urban hospitals (25.3% vs 24.9%). When urban hospitals were categorized as teaching or non-teaching, the rate in the urban non-teaching hospitals was identical to the rural rates with urban teaching hospitals contributing to the urban overall lower rates. Comparing rural and urban hospitals of similar sizes, c-section rates were generally higher in the rural hospitals with statistically significant differences in three of the five size categories. The difference between rural and urban rates ranged from 0.1 to 5.8 percentage points with the largest difference noted for the smallest hospitals (<10 ADC).

Across all hospitals, rural hospitals had a higher c-section rate on weekdays than did urban hospitals and a lower rate than urban hospitals on weekends. These differences were modest (<1%) and not statistically significant. However, when the weekday cesarean section rates were compared within hospital size

groups, rural rates were consistently higher and differences were statistically significant for three of the five groups. For weekend deliveries, however, only one rural size group (ADC=100-249) was statistically significantly higher. Overall VBAC rates varied significantly—the rate for urban teaching hospitals was 25.5% compared to 20% in urban non-teaching hospitals and 17.8% in rural hospitals. The finding that urban teaching hospitals have significantly higher VBAC rates may be an important factor in the observed differences in c-section rates. Although another possible explanation for the lower c-section rates in urban teaching settings is that these institutions often serve a larger proportion of Medicaid patients who are less likely to have c-sections, there may be offsetting reasons that could lead to higher rates in teaching hospitals, such as a more complicated case mix.

The cesarean section rate for rural hospitals was well above 10-15%, the rate recommended by the World Health Organization (WHO). Women who delivered babies in rural hospitals had cesarean sections at a rate that was also higher than their urban counterparts although the differences in rates were small and not always statistically significant. The fact that significant differences did exist, however, suggests that more information is needed to determine the appropriateness of these surgical procedures in a rural setting.

Further information is needed to control for case mix in rural hospitals. Rural women at risk for pregnancy complications may bypass local care and deliver by cesarean section in larger, urban hospitals. On the other hand, referral

to a larger hospital may obviate the need for c-section. Information on staffing patterns and obstetric coverage at rural hospitals would further inform an analysis of c-section rates. If obstetric practice guidelines are slower to reach rural areas, c-section rates may be slower to change. Technology and support staff may be limited in rural hospitals and prompt a faster move to c-section in anticipation of complications in women who will deliver in their rural community. Regional beliefs or practice patterns play a role in obstetric practice. Examination of patient preference and community patterns of care would help explain the differences in rates.

Whatever the underlying reasons, the finding that women who deliver at rural hospitals have higher c-section rates is important for those concerned with the provision of health care in rural settings as well as for rural residents. Surgery carries risk for both mother and baby. Surgical deliveries are also more expensive than vaginal deliveries and cost is a consideration for rural hospitals that may be operating close to the margin. A better understanding of the medical, health care system, professional and personal factors that contribute to c-sections in rural hospitals would inform changes in policy. It may be that a large portion of c-sections in rural hospitals are medically justified. However, absent such a comprehensive review, providers in rural hospitals can still monitor their own procedures and policies to assure that pregnant women they serve receive the most appropriate care whether it be at their rural hospital or at another hospital better suited to the needs of mother and baby.

Cesarean Section Patterns in Rural Hospitals

Childbirth by cesarean section (c-section) is major abdominal surgery that carries risk to both mother and baby. The justification for cesarean section deliveries includes both medical and non-medical reasons. Medical justification for c-sections includes breech presentation or other complications of delivery such as prolapsed uterus, in which a vaginal delivery may put the fetus at risk (Brink, 2002). Additionally, once a woman has had one birth by cesarean section, some obstetricians believe all subsequent births must be performed the same way to reduce the risk of uterine rupture (Greene, 2001). However, a number of studies, conducted primarily at teaching centers, show that vaginal births to women with previous deliveries by c-section, referred to as vaginal birth after cesarean or VBAC, can be performed safely. Throughout the early 1990s the VBAC rates increased as a result of a trial of labor for patients with prior c-sections (Menacker, 2001). Non-medical factors influencing use of c-section include patient convenience in scheduling delivery or preference for avoiding labor. There is also evidence that physician preference and practice styles influence c-section rates beyond documented evidence of medical risk factors and include provider concern about malpractice as well as avoidance of non-weekend deliveries (Goyert, 1989).

This study examines delivery patterns in rural hospitals and compares the cesarean section rate in rural hospitals to that in urban hospitals and to the national average. There are reasons to suggest that rates at rural hospitals might

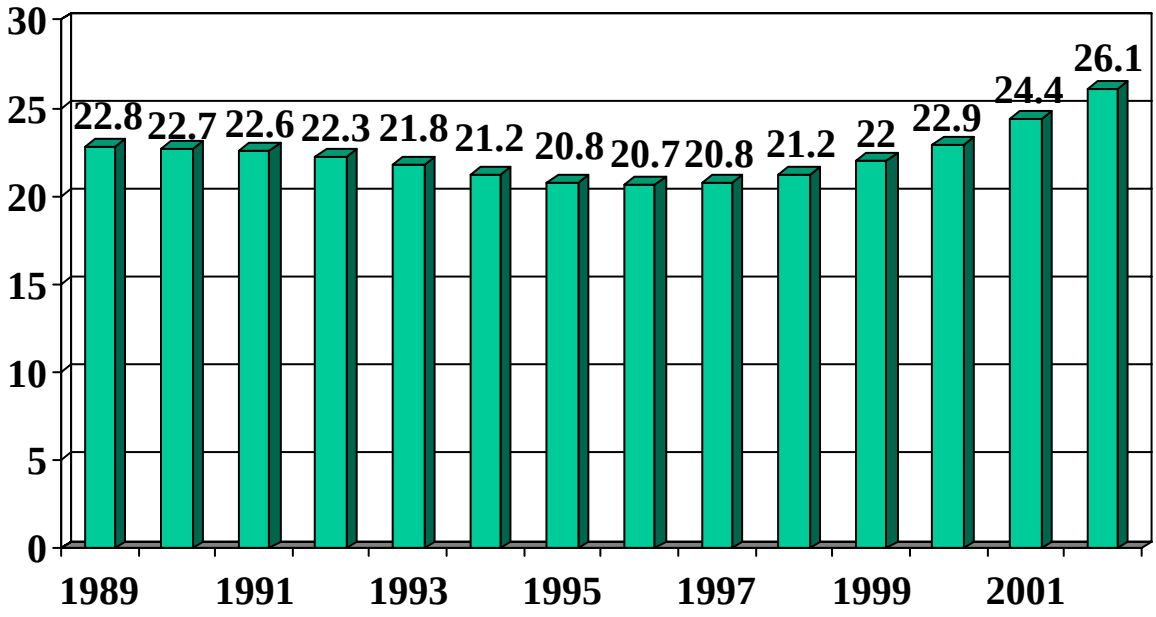
be different than rates at urban hospitals. Although a study published in 2003 demonstrates VBAC can be performed safely in a rural community (Upadhyaya, 2003), diffusion of best practices, such as the safe delivery of infants by VBAC, may be slower to reach rural communities, resulting in higher c-section rates at rural hospitals. Additionally, there may be non-medical reasons for an increased rate in rural facilities, particularly small hospitals. For example, lack of surgical coverage on weekends could lead to scheduled c-sections in anticipation of problems necessitating surgical intervention. On the other hand, physicians in rural areas may identify high risk pregnant women early and refer them to urban hospitals for care in anticipation of need for c-section, resulting in lower overall c-section rates at rural facilities. Measuring and understanding rural differences in delivery methods is important for monitoring the quality of obstetric care and making policy decisions on resources and staffing.

Background

National cesarean section rates as reported by the Centers for Disease Control and Prevention (CDC) reached 25% of births in 1988 (Obstetrics, 2002). Public outcry (as evidenced by lay press articles, insurer activity and hospital based physician review committees) and concerns about unnecessary surgery fueled efforts to reduce the rate in the early 1990s. The World Health Organization estimates that considering medical reasons alone, the appropriate cesarean section rate should range from 10-15% (WHO, 1985). The *Healthy People*

2000 goals for the nation set a target cesarean section rate of no higher than 15% by the year 2000 (US Dept of HHS, 1990). Many payers and providers undertook initiatives to address the issue of inappropriate cesarean surgeries and the rates began to slowly decline in the early 1990s, reaching a low of 20.7% in 1996. In recent years the rate has increased again, reaching 24.4% in 2001. Recently released data for 2002 indicates another jump in c-section rates to an all time high of 26.1% (Figure 1). In addition, 18.0% of first-time deliveries in 2002 were by c-section, a 7% increase from the previous year, and the VBAC rate dropped to a low of 12.6% (Martin, 2003).

Figure 1: Cesarean Section Rates in the United States



Source: Martin JA, Hamilton BE, et al. Center for Disease Control, National Vital Statistics Reports, Births: Final Data for 2002, Dec. 17, 2003.

Public concern has again been raised regarding the necessity for c-section. The reasons cited for the high and continually rising cesarean section rates, including previous c-sections, breech presentation, size of the mother, size of the baby, preference of the mother and convenience of the physician, continue to be debated (Williams, 2003 and Young, 2003). A recent birth certificate-based study of deliveries in Louisiana demonstrated that changes in that state's c-section rate from 1993 to 2000 were not related to changes in potential risk factors as reported on birth certificates and concluded there was a high rate of unnecessary c-sections (Kabir, 2004).

The national c-section rate as reported by the CDC is an overall rate for deliveries in all U.S. hospitals regardless of hospital type. However, there is variation in c-section rates by region and state, with some of the highest rates in southern states (Menacker, 2001). It has also been reported that cesarean section rates are highest for privately insured women and lowest for uninsured women (Jiang, 2002). C-section rates are not reported regularly for rural areas throughout the United States. However, a report on cesarean section rates in North Carolina suggests that while rates are higher than average in the state's large referral hospitals, the highest rates are in some of its rural facilities (Charlotte Observer, 2003). A study of delivery practices in Washington State rural hospitals found that while most had no obstetrician on staff, family practitioners performed c-sections, and performed them at rates similar to hospitals with obstetricians (Norris, 1996).

Data Source and Methods

Data from the 2001 Nationwide Inpatient Sample (NIS) were used for this study. The NIS is part of the Healthcare Cost and Utilization Project (HCUP) within the Agency for Healthcare Research and Quality and includes discharge data for all stays from a 20% stratified sample (N=986) of U.S. non-federal community hospitals. The sample is stratified on five hospital characteristics: ownership/control, bed size, teaching status, metropolitan location and U.S. region. The sample is designed to be representative of all U.S. hospitals in each stratum, and national estimates can be generated through use of survey weights included in the data.

Geographic regions as defined by the NIS are consistent with the U.S. Census regions of Northeast, Midwest, West and South. Hospitals are designated as in a metropolitan statistical area (MSA) or not. For the purpose of this study, hospitals in an MSA are referred to as urban hospitals and those not in an MSA are rural hospitals. Hospitals are considered to be teaching hospitals if they have an AMA sponsored residency program, are members of the Council of Teaching Hospitals, or have a ratio of full-time equivalent interns and residents to beds of .25 or higher.

The NIS characterizes hospitals as small, medium and large but the number of beds used to determine size varies by region and by the designation of rural, urban non-teaching and urban teaching. For example, in the Northeast the small rural hospital category includes those hospitals with 1-49 beds. In the West,

however, a small rural hospital is defined as one with 1-24 beds. For this study, a variable was created that categorizes hospitals according to volume of patient discharges in order to compare hospitals of similar patient volume across regions and urban/rural areas. This variable was created by summing the days of care for all discharges for each hospital and dividing by 365 days to calculate an average daily census (ADC). The ADC variable was then used as a proxy for hospital size. In this calculation, discharges with a length of stay of zero were assigned a one-day length of stay and hospitalizations for normal newborns were not included in the calculation of ADC.

Each discharge record contains diagnosis and procedure codes as well as a hospital identifier unique to the NIS. All deliveries performed in the sample hospitals were identified using DRGs 370-375 and were used as the denominators of the cesarean section rates. Within this group, cesarean sections to be included in the numerator were identified as DRGs 370 and 371. The proportion of deliveries that were by c-section was determined for all hospitals and for subsets of hospitals in the sample including rural, urban teaching, urban non-teaching, geographic region and hospitals by average daily census. C-section rates were also determined for patient payer categories. Table 1 shows the unweighted number of sample hospitals in each stratum.

Table 1: Number of Hospitals and Deliveries in the 2001 Nationwide Inpatient Sample

	Rural Hospitals (Total N=443)			Urban Hospitals (Total N=543)		
	No Births	With Births		No Births	With Births	
	Hospitals	Hospitals	Deliveries	Hospitals	Hospitals	Deliveries
Number of hospitals	131	312	107,267	129	414	696,826
By Average Daily Census*						
<10	89	86	6521	20	6	1866
10-24	34	92	20,072	24	27	12,739
25-49	7	66	26,897	26	37	20,503
50-99	0	48	29,457	24	73	72,095
100-249	1	20	24,320	31	187	311,091
250-499	0	0	0	4	72	225,769
500+	0	0	0	0	12	52,763

* See text for definition of Average Daily Census.

Source: Authors' calculations from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, 2001 Nationwide Inpatient Sample.

In the final step, nationwide rates were calculated using Stata software that accounts for the complex survey design of the NIS. All percentages reported in the Results section are weighted, and all analyses used proper techniques to generate consistent estimates of standard errors. The cesarean section rates presented in this paper were calculated for all hospitals represented in the NIS whether or not they performed a threshold number of deliveries or cesarean sections. The inclusion of all hospitals was intended to mirror the calculation of population-based measures of cesarean section use. However, with evidence that more than one-fourth of the hospitals do not perform deliveries at all and an additional 22 hospitals have less than 2% of their discharges for births, a

secondary analysis was performed to assess any bias associated with inclusion of hospitals with few to no deliveries. When c-section rates for only those hospitals where deliveries comprise greater than 2% of their discharges were compared to the rates for all hospitals, the differences in the rates were modest and insignificant.

Results

Twenty-six percent (26%) of hospitals had no childbirth discharges in 2001. As Table 2 shows, rural hospitals were less likely than urban hospitals to have deliveries (70% v. 76%) as were hospitals with lower ADCs. However, within average daily census strata smaller rural hospitals were much more likely to provide delivery services than were their smaller urban counterparts. Among the hospitals that reported discharges for childbirth, deliveries accounted for more than 2% of total discharges in all but 21 hospitals, suggesting that the facilities with less than 2% of discharges for childbirth may provide obstetric services only in emergency situations.

Table 2: Percent of Acute Care Hospitals Providing Delivery Services

	Rural Hospitals		Urban Hospitals	
	No Births	**Births**	**No Births**	**Births**
Total*	30%	70%	24%	76%
By Average Daily Census*				
<10	51%	49%	77 %	23%
10-24	27%	73%	47%	53%
25-49	10%	90%	42%	58%
50-99	0%	100%	25%	75%
100-249	5%	95%	14%	86%
250-499	NA	NA	5%	95%
500+	NA	NA	0%	100%

*All proportions have been weighted to account for survey sample.

Source: Authors' calculations from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, 2001 Nationwide Inpatient Sample.

Cesarean section rates by hospital size and location

Overall cesarean section rates were higher, though only slightly, in rural hospitals compared to urban hospitals, with rates of 25.3% and 24.9% respectively (Table 3). The rate in rural hospitals was identical to that of urban non-teaching hospitals (25.3%) but higher than that calculated for urban teaching centers (24.6%). The differences in the overall c-section rate among groups of rural, urban non-teaching, and urban teaching hospitals were not statistically significant, however.

Table 3: Cesarean Section Rate in Urban and Rural Hospitals, Total and By Average Daily Census

	Overall	Rural	Urban
All hospitals	25.0%	25.3%	24.9%
By ADC			
<10	22.0%	23.1%*	17.3%
10-24	23.5%	24.3%	22.1%
25-49	23.8%	24.9%*	22.4%
50-99	24.9%	24.8%	24.9%
100-249	24.5%	27.7%*	24.2%
250-499	26.1%	NA	26.1%
500+	26.0%	NA	26.0%
By Region			
Northeast	25.4%	23.4%	25.6%
Midwest	22.7%	24.1%	22.4%
South	27.0%	27.4%*	26.9%
West	23.7%	23.0%	23.8%

* Differences between urban and rural rates are significant at p=.05

Source: Authors' calculations from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, 2001 Nationwide Inpatient Sample.

When the hospitals are grouped by ADC categories, statistically significant differences in the cesarean section rates emerge (Table 3). Overall, the smallest hospitals had the lowest rate (22.0%) and the largest institutions had the highest (26.0%). When rural and urban hospitals of similar sizes are compared, cesarean section rates were generally higher in the rural hospitals, with statistically significant differences in three of the five ADC categories that include both rural and urban hospitals. The difference between rural and urban rates ranged from 0.1 to 5.8 percentage points with the largest difference noted for the smallest hospitals (<10 ADC.) Only one ADC group (50-99) had virtually no difference in rates.

Cesarean section rates also varied by geographic regions (Table 3). For all hospitals, rates were lowest in the Midwest (22.7%) and highest in the South (27.0%). The only statistically significant difference in rates between urban and rural hospitals in a given region was in the South where rates were higher in rural hospitals than they were in urban hospitals. Comparison of rural and urban hospitals by size is limited by the number of hospitals in each ADC stratum in each region. In the South, where the overall c-section rates are the highest and where overall rural rates were higher than urban rates, rural rates were not significantly higher for any of the four hospital size groups for which there were both urban and rural hospitals. In the Midwest, the region with the lowest overall rates, rural rates were significantly higher than urban rates in only one hospital category (25-49 ADC). In the West there were no significant differences in rates between rural and urban hospitals in the two size categories for which there were both urban and rural hospitals. The Northeast region had too few hospitals to compare urban and rural facilities within hospital size groups.

Cesarean section rates by day of occurrence

Since a planned cesarean section is most likely to be scheduled on a weekday, c-sections that occur on the weekends are more likely to represent emergency procedures. Consequently it was anticipated that the cesarean section rate would be greater during weekdays than on the weekends. The overall weekday cesarean section rate in the NIS was 26.8% compared to the weekend rate

of 18.0%. For all hospitals combined, rural hospitals had a higher c-section rate on weekdays than did urban hospitals and a lower rate than urban hospitals on weekends but no differences were statistically significant (Table 4). The weekend rate for both rural and urban hospitals is closer to the 15.0% goal set by *Healthy People 2000* than the overall cesarean section rate.

Table 4: Weekday versus Weekend Cesarean Rates

	Weekday		Weekend	
	Rural	**Urban**	**Rural**	**Urban**
All hospitals	27.1%	26.7%	17.5%	18.1%
By ADC				
<10	25.2%*	18.0%	14.8%	14.2%
10-24	26.1%	23.9%	16.3%	14.9%
25-49	26.8%*	23.8%	16.9%	16.4%
50-99	26.6%	26.6%	17.4%	17.8%
100-249	29.6%*	25.9%	20.0%†	17.7%
250-499	NA	28.0%	NA	18.7%
500+	NA	27.7%	NA	19.5%

* Difference between Urban and Rural Weekday Rates is significant at p<.05
† Difference between Urban and Rural Weekend Rates is significant at p<.05

Source: Authors' calculations from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, 2001 Nationwide Inpatient Sample.

When the weekday cesarean section rates were compared between urban and rural hospitals within hospital size groups, the rural rates were consistently higher and the differences were statistically significant for three of the five hospital size groups. However, for weekend deliveries, while rural rates were generally higher than urban rates in each hospital size category, only one difference was statistically significant.

Cesarean section rates by source of payment

As anticipated, cesarean section rates varied significantly by the patient's source of payment (Table 5). Patients with private insurance had the highest overall rate (26.4%) while the rate for Medicaid patients was lower (23.2%). Ninety-three percent (93%) of all deliveries were covered by private health insurance or Medicaid. The lowest cesarean rate (20.0%) was noted for those patients classified as self-pay, i.e., those with no health insurance. The c-section rate for the three percent of patients classified as "other" was 25.2%.

Table 5: Cesarean Section Rates by Payer

	Overall	Rural	Urban
Private/HMO	26.4%	26.4%	26.4%
Medicaid	23.2%	24.4%*	23.0%
Self pay	20.0%	21.6%	19.8%
Other	25.2%	26.7%	24.8%

* Differences between rural and urban rates are significant at p=.05

Source: Authors' calculations from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, 2001 Nationwide Inpatient Sample.

Only the Medicaid c-section rates varied significantly between urban and rural hospitals with a rural rate of 24.4% compared to 23.0% for Medicaid births in urban hospitals. This significant difference was also seen in three of the five hospital size categories. Among the private/HMO deliveries, the rates in rural hospitals in three size groups (<10, 10-24, 100-249 ADC) were significantly higher than in the urban facilities although the overall rate for private/HMO deliveries was not.

VBAC rates

To more fully understand the possible contributors to the observed higher c-section rates in rural hospitals, VBAC rates were compared across hospital categories. In fact, VBAC rates varied significantly among the three hospital types—the rate for urban teaching was 25.5%, compared to 20% in urban non-teaching and only 17.8% in rural, with all differences statistically significant. Of interest, the VBAC rate in the smallest rural hospitals (ADC<10) was higher than that in larger (ADC 100-249) rural hospitals, 21.5% compared to 15.9%. Finally, overall c-section rates were compared for childbirths where the mother had not had a previous c-section. There was no significant difference between the rural and urban rates (17.0% and 17.3% respectively).

Discussion and Conclusions

The observed overall cesarean section rate for the 2002 NIS was 25.0%, close to the 26.1% rate reported by the CDC based on birth certificate abstracts. The NIS is based on a large sample of hospital discharges and not a complete accounting of deliveries and cesarean sections in the United States. Birth certificate data are also incomplete due to some missing data on method of delivery. While these two data sources are different and each has limitations, the close results lend credibility to the study findings.

Based on the sample of hospitals in the NIS, the overall cesarean section rate in all rural hospitals was only slightly higher than the corresponding rate in

urban hospitals. When urban hospitals were categorized as teaching or non-teaching, the rate in the urban non-teaching hospitals was identical to the rural rate with urban teaching hospitals contributing to the urban overall lower rates. The finding that urban teaching hospitals have significantly higher VBAC rates may be an important factor in the observed differences in c-section rates. Although another possible explanation for the lower c-section rates in urban teaching settings is that these institutions often serve a larger proportion of Medicaid patients, who are less likely to have c-sections, there may be offsetting reasons that could lead to higher rates in teaching hospitals, such as a more complicated case mix.

Comparing overall cesarean section rates in rural hospitals to urban hospitals masks important differences associated with hospital size. A consistent finding was that cesarean section rates were higher in rural hospitals of specific sizes when compared to urban hospitals of the same size. This was found not only in the analyses of all urban and rural hospitals by size, but also in some analyses by region (South), by day of week (weekday), and by payer source (Medicaid). One contributor to higher rates in rural facilities may be the scheduling of these procedures when medical staff are available, as the difference in cesarean rates was greater on weekdays than on the weekends.

The cesarean section rate for rural hospitals was well above 10-15%, the rate recommended by the WHO. Women who delivered babies in rural hospitals had cesarean sections at a rate that was also higher than their urban counterparts

although the differences in rates were small and not always statistically significant. The fact that significant differences did exist, however, suggests that more information is needed to determine the appropriateness of these surgical procedures in a rural setting.

Further information is needed to control for case mix in rural hospitals. Women with complicated pregnancies might bypass smaller rural hospitals and seek care or be referred for care in larger institutions likely located in urban areas. This transfer of care suggests that urban c-section rates should be higher, rather than lower as demonstrated in this study. On the other hand, if at-risk women are referred or seek care at larger urban hospitals, such care might obviate the need for cesarean section. Knowing the medical diagnoses associated with each delivery would help evaluate the medical need for cesarean section.

Information on staffing patterns and obstetric coverage at rural hospitals would further inform an analysis of c-section rates. If obstetric practice guidelines are slower to reach rural physicians and/or family medicine physicians, c-section rates may be slower to change in rural areas. Technology and support staff may be limited in rural hospitals and prompt a faster move to c-section in anticipation of complications in women who deliver in their rural community.

The higher rate of c-section in the South suggests that regional beliefs or practice patterns play a role in obstetric practice. Examination of patient preference and community patterns of care would help explain the differences in rates.

Whatever the underlying reasons, the finding that women who deliver at rural hospitals have higher c-section rates is important for those concerned with the provision of health care in rural settings as well as for rural residents. Surgery carries risk for both mother and baby. Surgical deliveries are also more expensive than vaginal deliveries and cost is a consideration for rural hospitals that may be operating close to the margin. A better understanding of the medical, health care system, professional and personal factors that contribute to c-sections in rural hospitals would inform changes in policy. It may be that a large portion of c-sections in rural hospitals are medically justified. However, absent such a comprehensive review, providers in rural hospitals can still monitor their own procedures and policies to assure that pregnant women they serve receive the most appropriate care whether it be at their rural hospital or at another hospital better suited to the needs of mother and baby.

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