Comparing Patient Safety in Rural Hospitals by Bed Count

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Abstract

Objectives: Patient safety is an important national issue. To date, there has been little attention paid to patient safety in rural hospitals, which make up nearly half of all U.S. hospitals. Information is needed to target interventions for improving patient safety. Our objective was to determine how patient safety rates, offered services, and patient mix vary by bed count among rural hospitals. **Methods:** Using the 2000 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS), we calculated mean observed and risk-adjusted rates for 19 rural hospital patient safety indicators (PSIs), according to bed count. Rates were risk-adjusted for patient sex, age-gender interactions, comorbidities, and diagnosis-related group (DRG) clusters. We classified HCUP hospitals by actual bed counts—obtained from the AHA Annual Hospital Survey—rather than using the preclassified hospital bed size variable in the HCUP dataset (which differs by region). We examined by bed count the offered services and patient types treated by rural hospitals. *T*-tests and chi-square tests were used to determine statistically significant differences in continuous and categorical variables, respectively. Of the 446 rural hospitals in the NIS database, 144 facilities—primarily in the South—lacked AHA identifiers and therefore actual bed numbers could not be obtained. We studied the remaining 302 rural hospitals. Hospitals were classified into three size categories: small (fewer than 50 beds), medium (50–99 beds), and large (100 or more beds). **Results:** Small rural hospitals had rates of potential patient safety events that were significantly lower than those of large rural hospitals for three of the 19 PSIs (iatrogenic pneumothorax, infection due to medical care, and postoperative hemorrhage/hematoma). The types of services offered by rural hospitals varied significantly according to bed numbers, and the likelihood of an offered service increased as bed counts increased. The types of patients treated by rural hospitals, however, did not vary significantly by bed count. The results suggested that rural hospitals differ substantially by offered services and differ somewhat in PSI rates, relative to bed counts. But given the limited information on patient severity using administrative data, future research should look to develop more effective ways to account for patient severity when measuring patient safety rates among hospitals with varying bed counts. **Conclusions:** The size of rural hospitals and their bed counts may be important factors to consider when measuring patient safety, developing standards of care recommendations, and in the implementation and testing of patient safety interventions.

Introduction

Rural hospitals often are looked upon as a homogeneous group, but they are in fact very heterogeneous in terms of the services they offer, the complexity of their patients' needs, the level of technology available, and their access to tertiary care facilities. Reflecting these differences, it is likely that patient safety varies considerably among rural hospitals. Although 46 percent of U.S. hospitals are classified as rural, there is little current information available on how patient safety varies among rural hospitals.

Two previous studies provided direct patient safety measures among rural hospitals. In an early study, Brennan and colleagues[1] reviewed medical records to examine rates of adverse events in New York State hospitals. They found that rural hospitals had significantly lower rates of such events than did those hospitals affiliated with, or owned by, medical schools. And when controls for patient age and severity of illness were introduced, they discovered that rural hospitals in upstate New York had significantly fewer adverse events than did urban hospitals.

A more recent study by Romano and colleagues[2, 3] used risk-adjusted rates for 19 Patient Safety Indicators (PSIs) to compare rural and urban hospitals. The indicators, developed by the Agency for Healthcare Research and Quality (AHRQ), permitted researchers to estimate the potential for various patient safety-related errors in clinical care, including hospital-caused infections, postoperative problems, and obstetric complications. Generally speaking, rural hospitals had the lowest PSI-related rates of potential problems, while urban teaching hospitals had the highest rates, and nonteaching urban hospitals were in the middle. There were differences, however, in this pattern for individual PSIs: rural hospitals had the highest PSI rates for five of the 19 PSI categories: anesthesia reactions and complications, accidental punctures and lacerations, postoperative hip fractures, abdominopelvic wound dehiscence, and birth traumas. Urban teaching hospitals posted the highest rates for 11 of 19 PSI categories, and nonteaching urban hospitals had the highest rates for three of 19 PSIs.

Other studies have addressed patient safety in rural hospitals less directly, focusing on the relationship between patient volume and outcomes. These studies were found to have mixed results. Consistent with previous studies of volume and outcome, the Elixhauser, Steiner, and Fraser study[4] and the Heaphy and Bernard study[5] found that hospitals with low patient volume for various procedures had poorer patient outcomes. Conversely, Schlenker, Hittle, Hrincevich, and Kaehny[6] were unable to find a consistent relationship between hospital patient volume and outcomes. Unfortunately, each of these studies of patient numbers and outcomes had significant methodological limitations, including a lack of risk-adjustment for patient age and comorbidities, small sample sizes, or a limited number of studied procedures.

Although the previous studies found lower adverse event rates in rural hospitals, their comparisons of hospitals relied solely on location (rural/urban) and teaching status. They did not examine how patient safety varies among rural hospitals. Teaching status has shown to be a useful measure for comparing urban

hospitals, however, this variable is ill-suited for comparisons of rural hospitals, since the majority of rural hospitals are not teaching facilities. According to AHA Annual Hospital Survey data, the types of services offered by small rural hospitals (fewer than 50 beds) differs considerably from those offered by large rural hospitals (100 or more beds), suggesting that the number of hospital beds may prove a more useful measure when comparing patient safety rates among rural hospitals.[7]

In order to examine whether patient safety varies among rural hospitals, we used data from the 2000 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS), and the American Hospital Association Annual Survey Data for 2000 to answer three questions:

- What types of services are offered by rural hospitals?
- What types of patients do they treat?
- How do patient safety rates, measured using the AHRQ Patient Safety Indicators (PSIs), vary among rural hospitals?

Methods

We used the 2000 AHA Annual Survey to determine whether rural hospitals of varying bed counts differ in the types of services offered, such as obstetrical services, emergency departments, urgent care centers, etc.[7] We identified whether rural hospitals were contract-managed or were members of a health care system, a group purchasing organization, or a hospital network. We calculated mean occupancy rates and the mean number of inpatient and outpatient surgical procedures performed in rural hospitals by bed count category. We further used *t*-tests and chi-square tests to determine whether there was a significant difference by bed count for continuous and categorical variables, respectively.

To assess whether the types of patients treated in rural hospitals varied by bed count, we conducted a case-mix analysis of rural hospital patients. We used diagnosis-related groups (DRGs), provided in the NIS, to group patients by diagnoses and procedures. A single DRG is listed for each patient record. For each hospital, we calculated the total number of patients falling into each DRG. The results then were grouped according to hospital bed counts (small, medium, and large) and were ranked from most to least frequently occurring category.

The AHRQ Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS) is an all-payer database with data from nearly 1,000 U.S. hospitals in 28 states, representing a 20 percent stratified sample of non-Federal, short-term, general and specialty hospitals.[8] It has discharge information for each hospital sampled, including diagnosis information and procedures performed during hospitalization. The NIS provides data on hospital characteristics, including the region of the country, location (i.e., rural/urban), teaching status, and bed numbers (small, medium, or large). The American Hospital Association's Annual Hospital Survey has information on all U.S. hospitals, including hospital

characteristics, types of services (obstetrics, surgical, and diagnostics), and network affiliations.[7]

We used hospital bed counts to compare offered services and patient safety measures in rural hospitals. Given that hospital size in the HCUP NIS were used primarily to achieve a representative sample of hospitals, the information provided on hospital bed size is aggregated into general bed size categories. The categories varied by region, hospital location, and teaching status, thus limiting the cross-regional hospital comparisons that could be made. To remedy this problem, we classified HCUP hospitals by actual bed counts, obtained from the 2000 AHA Hospital Survey. Unfortunately, six States (Georgia, Hawaii, Kansas, South Carolina, Tennessee, and Texas) did not provide AHA identification information for each hospital sampled in the NIS. Therefore, we were unable to obtain actual bed numbers for 144 of the rural hospitals. The majority of these 144 hospitals were located in the South (77 percent) and the Midwest (22 percent), while a few were located in the West (1 percent). None of the 144 hospitals lacking identification data was located in the Northeast. We categorized the remaining 302 hospitals into three categories of bed capacity: fewer than 50 beds, 50–99 beds, and 100 or more beds.

To calculate the incidence of potential safety-related events, we used the Patient Safety Indicators (PSIs) and SAS-based software developed by AHRQ.[3, 9] The methodology used to develop the PSIs, as well as the definitions and detailed evidence for each PSI, can be found in AHRQ's guide to patient safety and quality indicators.[3] PSI rates were risk-adjusted for patient age, age-gender interactions, comorbidities and diagnosis-related group (DRG) clusters, with the exception of the four PSIs related to obstetrics (birth trauma, obstetric trauma–cesarean delivery, obstetric trauma–vaginal delivery with instrumentation, and obstetric trauma–vaginal delivery without instrumentation). These PSI rates could not be not risk-adjusted, due to the lack of available information.[3] To adjust for comorbidities, AHRQ adopted a modified version of the Elixhauser approach, which has been shown to perform better than other methods (e.g., the Charlson method) and has been validated independently.[10, 11] In this approach, Elixhauser and colleagues limited the list of potential comorbidities by several factors, including its relation to the principal diagnosis and its importance in the patient's reason for hospitalization.

Since we dropped a number of hospitals when we obtained actual bed counts from the AHA database, we were unable to weight the PSI rates to generate estimates for the entire population of rural community hospitals in the United States. Moreover, we did not calculate the incidence of potential safety-related events due to transfusion reactions in rural hospitals, because of the low rate of occurrence. We calculated the mean incidence for rural hospitals using bed numbers, for the remaining 19 PSIs. *T*-tests were used to determine statistically significant differences between the groups.

Results

Types of services offered by rural hospitals

Several of the studied services are "core services," offered by most (90 percent or more) hospitals, regardless of bed counts (Table 1). These include inpatient and outpatient surgery, emergency care, CT scans, and ultrasound. For the remaining services, the likelihood that a rural hospital offers the service increases with the number of patient beds. Rural hospitals with less than 50 beds are much less likely than larger rural hospitals to offer obstetrics services, intensive care units, medical or surgical intensive care units, and urgent care centers. In addition, large rural hospitals are more likely to offer Magnetic Resonance Imaging (MRI), Diagnostic Radio-Isotope, Positron-Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT), and Extracorporeal Shockwave Lithotripsy (ESWL). Relatively few rural hospitals provide cardiac services, with large hospitals being the most likely to offer angioplasty and cardiac catheterization. A greater proportion of small hospitals are contract-managed, compared with medium-sized and large hospitals.

Measures of hospital utilization also varied by bed count (Table 2). Large hospitals, for example, performed 1,628 inpatient surgeries per year compared to 251 inpatient surgeries per year in small hospitals. While occupancy rates in large rural hospitals averaged 56 percent annually, mean occupancy rates in small rural hospitals averaged 46 percent annually. Finally, large rural hospitals averaged more than 30,000 inpatient days per year, while small hospitals averaged slightly more than 7,000 days annually.

Types of patients treated by rural hospitals

The most common types of patients treated by rural hospitals do not vary greatly by bed count (Table 3). Cardiovascular conditions and obstetric deliveries were the most common DRGs among all bed count categories. For example, seven or eight of the most common DRGs in each group were related to the heart or circulatory system, and four or five of the most common DRGs were related to childbirth deliveries. Almost all of the most frequent DRGs were associated with medical conditions. Only two of the top 25 DRGs in small and medium hospitals were associated with procedures, while in large hospitals only three DRGs involved procedures. The top 25 DRGs in small and medium hospitals represented slightly more than half (52.3 percent and 52.5 percent, respectively) of the discharges in 2000. The results were the same for large hospitals (50.2 percent). The top 25 DRGs were virtually the same across the three groups. This suggests that there is little difference in case mix by hospital size for the most common conditions.

Table 1. Profile of rural hospitals by bed count, AHA 2000 survey (N = 302): categorical variables

	Percent of Hospitals Reporting "Yes" (Number of Hospitals Reporting)			
	<50 Beds	**50-99 Beds**	**100+ Beds**	**Total**
Hospital totals	176	72	54	302
Services				
Obstetrics*	57.8% (154)	79.7% (64)	91.7% (48)	69.2% (266)
Any intensive care units*	52.6% (154)	87.5% (64)	100% (48)	69.6% (266)
Medical/surgical ICU*	50.0% (154)	82.8% (64)	93.8% (48)	65.8% (266)
Inpatient surgery	93.2% (176)	100% (72)	98.2% (54)	96.4% (302)
Outpatient surgery	97.7% (176)	100% (72)	100% (54)	98.7% (302)
Emergency departments	100% (154)	98.4% (64)	97.9% (48)	99.3% (266)
Urgent care centers†	19.5% (154)	35.9% (64)	37.5% (48)	26.7% (266)
Trauma centers	39.0% (154)	32.8% (64)	31.3% (48)	36.1% (266)
Diagnostic Services				
MRI*	30.5% (154)	54.7% (64)	77.1% (48)	44.7% (266)
CT scanner	90.9% (154)	95.3% (64)	97.9% (48)	93.2% (266)
Diagnostic radio-isotope*	34.4% (154)	62.5% (64)	87.5% (48)	50.8% (266)
PET†	1.3% (154)	1.6% (64)	10.4% (48)	3.0% (266)
SPECT*	9.1% (154)	32.8% (64)	56.3% (48)	23.3% (266)
Ultrasound	90.9% (154)	95.3% (64)	95.8% (48)	92.9% (266)
Radiation therapy*	5.2% (154)	12.5% (64)	52.1% (48)	15.4% (266)
ESWL*	4.6% (154)	7.8% (64)	31.3% (48)	10.2% (266)
Cardiac Care				
Angioplasty*	0.0% (154)	1.6% (64)	31.3% (48)	6.0% (266)
Cardiac catheterization*	1.0% (154)	9.4% (64)	58.3% (48)	13.2% (266)
Organizational Structure				
System member	34.5% (145)	36.1% (61)	48.9% (47)	37.6% (253)
Contract-managed†	33.1% (145)	24.6% (61)	6.4% (47)	26.1% (253)
Group purchaser	86.9% (145)	90.2% (61)	89.4% (47)	88.1% (253)
Network participant	32.4% (145)	31.2% (61)	29.8% (47)	31.6% (253)

Data Source: Annual Survey of Hospitals, AHA 2000
* Significantly different at $P < 0.01$
† Significantly different at $P < 0.001$
MRI = magnetic resonance imaging; CT scanner = computed-tomography scanner; PET = positron emission tomography; SPECT = single photon emission computed tomography; ESWL = extracorporeal shock-wave lithotripte

Table 2. Characteristics of rural hospitals by bed count, AHA 2000 survey: continuous variables

	<50 Beds	50–99 Beds	100+ Beds
Hospital totals	139	49	31
Mean occupancy rate	45.6*†	54.7†	56.1‡
Mean number of admissions	8,739*†	21,875†	37,959*‡
Mean number of total surgeries	956*†	2,584†	5,439*‡
Mean number of inpatient surgeries	251*†	683†	1,628*‡
Mean number of outpatient surgeries	706*†	1901†	3,811*‡

* Significantly different from hospitals with 50-99 beds at $P < 0.01$.
† Significantly different from hospitals with 100+ beds at $P < 0.01$.
‡ Significantly different from hospitals with <50 beds at $P < 0.01$.

Patient Safety Indicator rates

The highest PSI rates were the same for the small, medium, and large rural hospitals: obstetric trauma–vaginal with instrumentation, failure to rescue, and obstetric trauma–vaginal without instrumentation (Table 4). Problem rates in small and large rural hospitals varied significantly for three of the 19 PSIs studied: iatrogenic pneumothorax, infection due to medical care, and postoperative hemorrhage/hematoma.

In each case, the small hospitals had lower rates than did the large hospitals. In addition, the small hospitals had rates lower than the medium hospitals for two of the PSIs: postoperative hip fracture and postoperative hemorrhage or hematoma. Large hospitals had significantly higher rates for postoperative respiratory failure, compared with the medium-sized hospitals.

Discussion

Rural hospitals with different patient capacities are similar in terms of the "core" services they offer, including inpatient and outpatient surgery, and emergency care. For services such as intensive care, MRI scans, and angioplasty, however, the availability of the service in rural hospitals is strongly related to bed numbers; larger hospitals are more likely to offer such services. Previous work has shown that PSI rates differ according to location and bed numbers. Our analysis indicates, at least among rural hospitals, that PSI rates differ significantly by bed count for 5 of the 19 studied indicators. Small rural hospitals tend to have lower PSI rates than do medium or large rural hospitals.

Table 3. Twenty-five most frequent diagnosis-related groups (DRGs) for rural hospital patients by bed count

<50 Beds		50–99 Beds		100+ Beds	
DRG Name	**Cumulative %**	**DRG Name**	**Cumulative %**	**DRG Name**	**Cumulative %**
Normal newborn	6.7	Normal newborn	7.2	Normal newborn	7.2
Vaginal delivery w/o complicating diagnoses	12.2	Vaginal delivery w/o complicating diagnoses	13.2	Vaginal delivery w/o complicating diagnoses	13.1
Simple pneumonia	17.0	Simple pneumonia	17.1	Heart failure & shock	16.5
Heart failure & shock	21.2	Heart failure & shock	20.9	Simple pneumonia	19.5
COPD	24.7	Psychoses	23.8	COPD	22.3
Digestive disorders w/ CC	27.1	COPD	26.6	Psychoses	25.0
Chest pain	29.4	Chest pain	29.0	Chest pain	27.0
Cerebrovascular disorders	31.2	Digestive disorders w/ CC	30.9	Cesarean section w/o CC	28.8
GI hemorrhage w/ CC	32.8	Major joint/limb reattachment	32.7	Major joint/limb reattachment	30.6
Digestive disorders w/o CC	34.4	Cerebrovascular disorders	34.5	Esophagistis, gastroent & digestive disorders w/ CC	32.4
Nutrition and metabolic disorders w/ CC	36.0	GI hemorrhage w/ CC	36.1	Cerebrovascular disorders	34.0
Cesarean section w/o CC	37.4	Uterine & adnexa proc for non-malignancy w/o CC	37.7	Uterine & adnexa proc for non-malignancy w/o CC	35.6
Kidney & urinary tract infections w/ CC	38.8	Cesarean section w/o CC	39.2	Pacemaker implant or PTCA w/ coronary artery stent	37.1
Major joint/limb reattachment	40.1	Nutrition and metabolic disorders w/ CC	40.6	Neonate w/ significant problems	38.5
Cardiac arrhythmia w/ CC	41.4	Atherosclerosis w/ CC	41.9	Atherosclerosis w/ CC	39.8
Medical back problems	42.6	Esophagistis, gastroent & digestive disorders w/o CC	43.2	GI hemorrhage w/ CC	41.1

Table 3. Twenty-five most frequent diagnosis-related groups (DRGs) for rural hospital patients by bed count, cont.

<50 Beds		50–99 Beds		100+ Beds	
DRG Name	**Cumulative %**	**DRG Name**	**Cumulative %**	**DRG Name**	**Cumulative %**
Uterine & adnexa proc for non-malignancy w/o CC	43.8	Cardiac arrhythmia w/ CC	44.4	Nutrition and metabolic disorders w/ CC	42.4
Neonate w/ significant problems	45.0	Neonate w/ significant problems	45.5	Cardiac arrhythmia w/ CC	43.5
Atherosclerosis w/ CC	46.1	Circulatory disorders w/ AMI & major comp.	46.6	Esophagistis, gastroent & digestive disorders w/o CC	44.6
Resp. infections & inflammations w/ CC	47.2	Kidney & urinary tract infections w/ CC	47.7	Septicemia	45.6
Angina pectoris	48.3	Septicemia	48.7	Rehabilitation	46.6
Septicemia	49.3	Resp. infections & inflammations w/ CC	49.7	Bronchitis & asthma age 0-17	47.5
Circulatory disorders w/ AMI & major comp.	50.3	Angina pectoris	50.7	Circulatory disorders w/ AMI & major comp.	48.4
Simple pneumonia	51.3	Bronchitis & asthma age 0-17	51.6	Kidn. & urin. tract infections w/CC	49.3
Diabetes, age>35	52.3	Circulatory disorders w/ AMI & w/o major comp.	52.5	Vaginal delivery w/ complicating diagnoses	50.2

Table 4. Patient Safety Indicator rates for rural hospitals by bed count, 2000

Mean rate of potential patient safety events (Number of hospitals)			
	Hospital bed count		
Patient safety indicator	**<50 Beds**	**50–99 Beds**	**100+ Beds**
Anesthesia reactions and complications	0.09% (156)	0.09% (70)	0.08% (54)
Deaths in low-mortality DRGs	0.10% (176)	0.12% (72)	0.06% (54)
Decubitus ulcer	1.7% (176)	1.6% (71)	1.4% (54)
Failure to rescue	10.6% (157)	12.2% (69)	13.1% (54)
Foreign body left during procedure	0.004% (176)	0.01% (72)	0.01% (54)
Iatrogenic pneumothorax	0.05% (176)†	0.06% (72)	0.07% (54)
Infection due to medical care	0.09% (176)†	0.10% (72)	0.13% (54)
Postoperative hip fracture	0.12% (153)	0.18% (69)	0.14% (54)
Postoperative hemorrhage/hematoma	0.06% (155)* †	0.12% (69)	0.14% (54)
Postoperative physiologic or metabolic derangement	0.04% (111)	0.06% (48)	0.05% (51)
Postoperative respiratory failure	0.19% (108)	0.13% (48)†	0.25%(51)
Postoperative thromboembolism	0.62% (144)	0.59% (69)	0.67% (54)
Postoperative septicemia	0.5% (82)	1.2% (47)	1.3% (49)
Postoperative abdominopelvic wound dehiscence	0.15% (144)	0.27% (69)	0.21% (54)
Accidental puncture or laceration	0.33% (176)	0.34% (72)	0.35% (54)
Birth trauma	0.39% (95)	0.27% (52)	0.75% (52)
Obstetric trauma–vaginal w/ instrumentation	21.2% (90)	18.6% (55)	21.9% (52)
Obstetric trauma–vaginal w/o instrumentation	8.2% (111)	8.0% (57)	8.7% (52)
Obstetric trauma–cesarean	0.58% (105)	0.54% (58)	0.43% (52)

Data Source: HCUP NIS, 2000
* Significantly different from hospitals with 50-99 beds at $P < 0.01$.
† Significantly different from hospitals with 100+ beds at $P < 0.01$.

Although we found that patient safety rates vary among rural hospitals, our study does have limitations. Our sample size was limited to 302 rural hospitals, due to the lack of AHA identifiers for 144 rural hospitals. Incorporating actual bed counts into the HCUP database or creating uniform bed count categories across regions of the U.S could increase the potential usefulness of the data for studying rural hospital subgroups.

Given that risk adjustments provided limited information concerning patient illness severity, the differences in PSI rates may be attributable to variations in the complexity of the cases treated among rural hospitals. To address this issue, we

conducted several regression analyses testing the impact of using additional independent variables to refine measures of patient illness severity. For the obstetric trauma indicators, we used the mother's age as a proxy for high-risk pregnancies and/or a lack of prenatal care. We further calculated the percentage of mothers under the age of 18 years (lack of prenatal care) or over the age of 44 years (high risk). However, the inclusion of this variable in the analysis did not alter the results.

We then considered two measures of trauma service: whether or not the hospital had a trauma center, and the level of trauma service (regional, community, or rural). Trauma center information for the hospitals included in the study was limited, as 36 of the 302 rural hospitals did not provide this information. Moreover, just 92 of the 302 rural hospitals provided information on the level of trauma service offered (3 were regional centers, 20 were community centers, and 59 were rural centers). The remaining 174 hospitals did not indicate a trauma center. Given the small numbers of hospitals with regional or community centers, we focused on measuring trauma service as a dichotomous variable (whether they had a trauma center or not). The results of the model including bed numbers and trauma center were different for two of the PSIs (postoperative physiologic or metabolic derangement and postoperative septicemia), but not for the balance of the indicators. And while these findings suggest that trauma service may have some impact, the lack of available information limits the usefulness of this variable in providing a control for patient severity.

Finally, we examined ICU bed numbers and their impact on our model. This variable was highly correlated with total bed numbers, however, (0.79 for all HCUP hospitals and 0.6 for rural hospitals) which introduced a problem of multicolinearity. Since total bed numbers were available for nearly all rural hospitals, while the ICU bed counts were limited to hospitals with ICUs, we elected to use total bed numbers in the model.

Although this study and previous work by Romano suggest that patient safety error rates increase as hospital size increases, the limited adjustment for patient illness severity may not provide an accurate estimate of the risk associated with patient safety-related problems. Therefore, better measures of patient illness severity may reduce the differences found in patient safety rates by hospital size, and so our findings should be regarded with caution. Future research might address this problem, using Refined DRGs or the Prospective Payment System relative payment weight for each DRG to better control the patient illness severity.

Conclusion

Patient safety in rural hospitals has only recently begun to garner attention. The HCUP and AHA databases have provided useful information on rural hospital patient safety that can serve to generate hypotheses for future research and for planning patient safety improvement interventions targeting rural hospitals. Based on the differences we observed among rural hospitals of different

sizes, this study suggests that bed counts should be considered when measuring patient safety rates, when making recommendations for standard safety improvement practices, and when planning and testing interventions designed to improve patient safety.

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