

## LETTER TO THE EDITOR

# Healthcare costs and outcomes for pediatric inpatients with bronchiolitis: comparison of urban versus rural hospitals

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## Dear Editor

There are limited and conflicting studies examining the quality of health care in rural versus urban settings<sup>1-4</sup>. This research is even more limited when it pertains to pediatrics care<sup>5</sup>. To date, no studies have examined quality as it relates to healthcare costs within the United States.

We conducted a retrospective study to compare the quality and costs of care among rural and urban hospitals for low severity pediatric bronchiolitis admissions. The Agency for Healthcare Research and Quality 2009 Kids' Inpatient Database provided the data for analysis. Diagnosis and severity of illness levels were based on All Patient Refined Diagnosis-Related Groups (APR-DRG) of 138: bronchiolitis and respiratory syncytial virus pneumonia. We included the lowest severity of illness, as defined by APR-DRG severity classification, comprising 58.8% of all pediatric bronchiolitis

discharges. The Institutional Review Boards of Sanford Health and Sanford School of Medicine approved this study (Sanford Health Project Number 03-12-001, meets exempt status; Sanford School of Medicine Project Number 2011.210; meets exempt status).

Rural and urban status was based on Core Based Statistical Area codes. Additional variables included hospital ownership, National Association of Children's Hospitals and Related Institutions status, and teaching versus non-teaching designations. Hospital costs were determined by using hospital specific cost-to-charge ratios as obtained from each hospital's accounting reports.

Weighted statistical analyses were conducted using STATA/IC 12.1 (<http://www.stata.com/stata12/>). Given the complex sampling survey data present, we utilized the weighted analysis function ('syv' command) to determine the



mean and 95% confidence intervals. Adjusted Wald tests assessed statistical significance across populations.

In 2009, there was a total of 11,161 patients admitted to rural hospitals and 54,654 admitted to urban hospitals (Table 1). Comparing patients admitted to rural versus urban hospitals, we found statistically different but clinically comparable age (0.5 vs 0.4 years,  $p<0.001$ ) and gender (42.1 vs 40.7% females,  $p=0.03$ ) with similar number of chronic

conditions (0.12 vs 0.12 conditions,  $p=0.15$ ) (Table 2). Number of procedures received was lower in rural hospitals (0.04 vs 0.13,  $p<0.001$ ). Daily hospital costs were 10.9% lower (\$1,136 vs \$1,259,  $p<0.001$ ) and total hospital costs were 19.5% lower (\$2,401 vs \$2,868,  $p<0.001$ ) in rural hospitals with similar mortality rates (0% for both) and statistically different but clinically comparable lengths of stay (2.3 vs 2.4 days,  $p<0.001$ ).

**Table 1: Comparison of rural and urban hospitals**

Characteristic	Rural			Urban		
	Mean	95% CI	%	Mean	95% CI	%
Ownership (n=68,170)						
Government, non-Federal	3,006	2,861–3,151	24.5	6,924	6,731–7,118	12.4
Private, non-profit	6,811	6,622–7,000	55.6	40,862	40,567–41,158	73.1
Private, invest-own	2,440	2,317–2,564	19.9	8,126	7,922–8,331	14.5
Teaching status (n=68,170)						
Non-teaching	11,445	11,197–11,693	93.4	23,210	22,919–23,500	41.5
Teaching	812	744–880	6.6	32,703	32,392–33,014	58.5
NACHRI hospital type (n=65,814)						
Non-children's hospital	11,130	10,888–11,372	99.7	33,811	33,516–34,106	61.9
Children's general hospital	0	0–0	0.0	9,245	9,022–9,469	16.9
Children's specialty hospital	0	0–0	0.0	5	0–10	0.0
Children's unit within a general hospital	30	17–43	0.3	11,593	11,363–11,823	21.2
Employee makeup						
% RN among licensed nurses (n=64,110)	83.2	82.9–83.5		94.2	94.1–94.2	
RN FTEs/1000 adjusted patient days (n=64,120)	3.05	3.02–3.08		4.64	4.62–4.65	
LPN FTEs/1000 adjusted patient days (n=64,136)	0.59	0.58–0.60		0.26	0.26–0.26	
Nurse aides FTEs/1000 adjusted patient days (n=64,124)	0.87	0.86–0.88		1.01	1.01–1.02	

CI, confidence interval. FTE, full time equivalent. LPN, licensed practical nurse. NACHRI, National Association of Children's Hospitals and Related Institutions. RN, registered nurse.

**Table 2: Comparison of discharges from rural and urban hospitals**

Characteristic	Rural		Urban		p-value
	Mean	95% CI	Mean	95% CI	
Total no. patients (n=68,170)	12,257	12,002.8–12,511.1	55,913	55,678.4–56,147.6	
Age (years) (n=67,814)	0.5	0.5–0.6	0.4	0.4–0.4	<0.001
Gender (% female) (n=67,473)	42.1	41.0–43.2	40.7	40.2–41.2	0.03
Number of chronic conditions (n=68,170)	0.12	0.11–0.12	0.12	0.12–0.13	0.15
Length of stay (days) (n=68,170)	2.3	2.2–2.3	2.4	2.4–2.4	<0.001
No. procedures received (n=68,170)	0.04	0.04–0.05	0.13	0.12–0.14	<0.001
Mortality (% died) (n=68,156)	0.0	–	0.0	–	–
Cost per day 2009 (\$) (n=60,792)	1,136	1,099–1,173	1,259	1,253–1,266	<0.001
Total cost 2009 (\$) (n=62,356)	2,401	2,324–2,477	2,868	2,845–2,890	<0.001

CI, confidence interval.



For pediatric inpatients with low severity bronchiolitis, we found that costs of care were higher in urban versus rural centers. Additionally, we found that care in urban hospitals did not improve quality outcomes, as mortality and length of stay were comparable.

These findings suggest that medical care for routine, low severity, pediatric diagnoses such as bronchiolitis may be more cost effective in rural versus urban centers. As previous studies focused primarily on quality of care, this is the first study we know of that documented lower costs of care in rural settings versus urban settings with comparable quality and outcomes.

We hypothesize that increased costs in urban settings may be influenced by factors including the higher proportion of teaching hospitals, greater competition for employees, and more procedures performed. This can have deep policy implications for the move toward regionalization of care within the United States.

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## References

1. Paquette IM, Zuckerman R, Finlayson SR. Perforated appendicitis among rural and urban patients: implications of access to care. *Annals of Surgery* 2011; **253(3)**: 534-538.
2. Lynch CP, Strom JL, Egede LE. Disparities in diabetes self-management and quality of care in rural versus urban veterans. *Journal of Diabetes and its Complications* 2011; **25(6)**: 387-392.
3. Hicks PC, Bublitz Emsermann C, Westfall JM, Parnes B. Comparison of HTN management in patients with diabetes between rural and urban primary care clinics in Northeastern Colorado - a report from SNOCAP. *Rural and Remote Health* **10(1)**: 1279. (Online) 2010. Available: [www.rrh.org.au](http://www.rrh.org.au) (Accessed 28 October 2014).
4. Sheikh K, Bullock C. Urban-rural differences in the quality of care for Medicare patients with acute myocardial infarction. *Archives of Internal Medicine* 2001; **161(5)**: 737-743.
5. Lorch SA, Zhang X, Rosenbaum PR, Evan-Shoshan O, Silber JH. Equivalent lengths of stay of pediatric patients hospitalized in rural and nonrural hospitals. *Pediatrics* 2004; **114(4)**: e400-e408.