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The Intersection of Residence and Area Deprivation: The Case of Hospitalizations from Ambulatory Care Sensitive Conditions Among Children

This brief is the second in a series providing information on the role of residence and community deprivation on potentially avoidable hospitalizations among children. This brief describes the findings from a nine-state sample of children's hospitalizations and discusses the potential implications for rural health research and policy.

Key Findings

Rural residence alone was not predictive of ACSC hospitalization, but the effect of rural was greater in communities with higher levels of deprivation

Hospitalization rates from ACSC did increase with the worsening of area deprivation

Rates of hospitalization were higher among children with Medicaid as an expected source of payment

African American children and those of Hispanic ethnicity experienced higher rates of ACSC hospitalization than white children

The passing and implementation of the 2010 Affordable Care Act (ACA) ushered in a new era for the delivery of health services in the United States. The broad goals of expanding insurance coverage, controlling health care costs, and improving health care delivery system are ambitious and have implications for providers and the population. Observers have suggested that expanding insurance and decreasing financial barriers for receipt of health services will increase the demand for healthcare; simultaneously, the existing supply of providers remains constrained, as they struggle to accommodate new patients.[1,2] Prior to the ACA, constrained supply was an existing hurdle for ensuring access to quality primary care services in rural and underserved communities. There is real concern that increasing demand for healthcare services stemming from the ACA could further exacerbate existing challenges in obtaining primary care in rural and underserved communities—particularly for children.

A recent study by the South Carolina Rural Health Research Center examined this issue using hospitalizations from Ambulatory Care Sensitive Conditions (ACSC), or those deemed potentially avoidable in the presence of adequate primary care. Using a nine-state sample of inpatient hospitalizations among children (age less than 19) from 2011, the study examined the intersection of area deprivation and rural residence. Findings from this study suggest that area deprivation—or disadvantages stemming from social and economic factors—is more closely associated with a higher likelihood of potentially avoidable hospitalizations than rurality alone. Interestingly, however, worsening deprivation seemed to have a more substantial impact in rural than in urban counties. These findings suggest that not all rural communities experience the same level of deprivation, but residents of rural counties with greater social and economic disadvantage experience a higher risk of hospitalizations from potentially avoidable hospitalizations than is observed in similarly deprived urban communities.

The ability to characterize existing vulnerabilities of the primary care system for children and have metrics to monitor these changes over time is important, particularly as ACA implementation continues to unfold. The remainder of this brief describes the study, explains the findings in more detail, and comments on the relevance for rural and child health policy.

Background

ACSC Hospitalizations

ACSC hospitalizations can serve as an effective metric for monitoring the availability of effective primary care delivered to children subsequent to and following the implementation of the ACA. Hospitalizations from ACSC conditions, or those deemed by medical professionals as potentially avoidable, are an increasingly common measure of access to primary care. ACSC hospitalizations also have cost implications, with estimates suggesting that decreasing the rate by 5% would result in a cost saving of more than $1.3 billion.[3] The Agency for Healthcare Research and Quality (AHRQ) has adopted ACSC hospitalization as a Prevention Quality Indicators measuring access to appropriate primary care.

Previous research has noted hospitalization for ACSC diagnoses are more common among rural than among urban populations,[4-7] suggesting gaps in service availability or quality for rural populations. Among children however, these findings are mixed. Some literature suggests that hospitalizations from ACSC are higher among rural children.[5-7] However, other research has found no associations between rural residence and ACSC hospitalizations for this population.[4] The majority of studies are limited in focus and tend to be single state focused or oriented to a small number of ambulatory care sensitive conditions.[8]

Our Study

As ACA implementation continues, the realized impact of these policies on effective primary care delivery for children remains largely unknown. There is however, a need to understand the existing vulnerabilities of the primary care system for children and have metrics to monitor these changes over time. The present study examines these vulnerabilities prior to ACA implementation using hospitalizations from ACSC among children in a representative sample of rural and urban communities.

The intersection of rurality and area deprivation was examined using a nine-state sample of inpatient hospitalizations among children (< 19 years of age) from 2011. One state from each of the nine census regions was selected and included in the sample. We conducted a cross-sectional analysis of hospital discharge data from the 2011 AHRQ State Inpatient Databases (SID). Although 44 states participate in the SID, only 24 provide the patients' county of residence. From this 24, nine states were chosen, using a selection algorithm that provided: 1] one state from each of the nine Census regions; 2] adequate numbers of discharges; 3] adequate numbers of rural counties; 4] adequate representation of minority children; and 5] cost-effective data purchase.

In total, the selected states contain 552 counties (about 18% of all counties in the US). Two of the states (Florida and New York) comprise 64% of the total sample, while two states (Vermont and South Dakota) comprise < 2.0% of the total sample. The remaining 34% of the sample population is distributed somewhat equally among the remaining five states (Arkansas, Colorado, Michigan, Mississippi, and Washington).

Hospitalization for an ACSC versus other conditions, the outcome of interest, was defined using the diagnosis list developed by Lu and Kuo.[9] We then created an area deprivation index to provide a practical measure of county-level deprivation using public and readily available data. The deprivation index included all counties in the United States and was constructed to capture varying degrees of community vulnerability. The area deprivation index can be used in conjunction with rurality to identify differences in the rate of ACSC hospitalizations among children in the sample states. In this study we examined the interaction of rurality and area deprivation, to determine the extent to which observed effects of rurality vary within comparable levels of area deprivation. A more detailed explanation of the area deprivation index can be found at (http://rhr.sph.sc.edu).

Study Findings

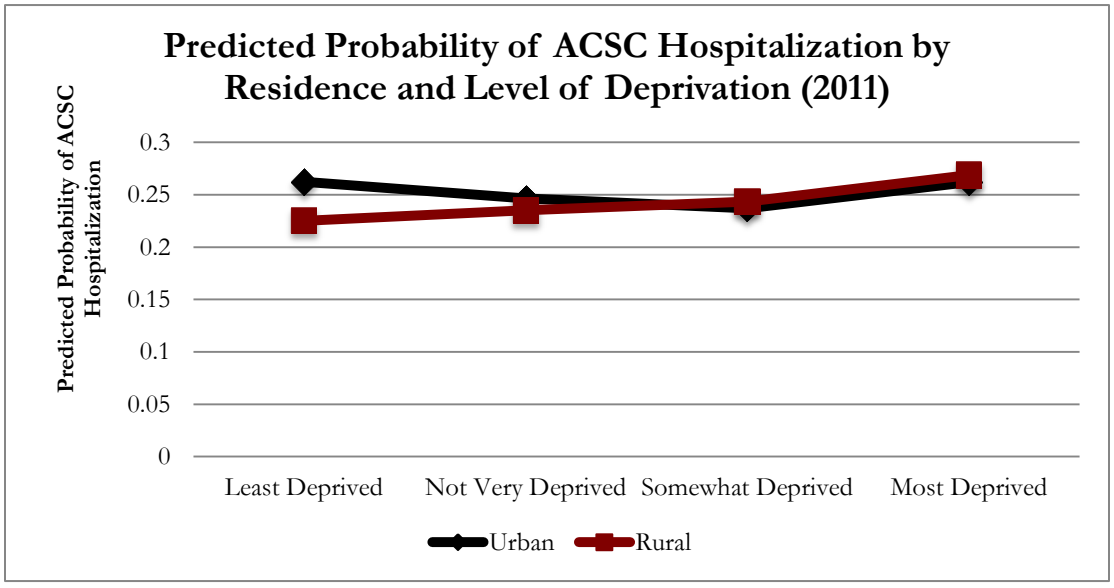
Rural Alone is Not a Strong Predictor of ACSC Hospitalization

Initial examination of ACSC hospitalization rates among children in rural and urban communities showed no differences. Among children who were hospitalized for any reason, approximately 25% urban children had an ACSC diagnosis compared to 24% among rural children. Some differences were noted between levels of area deprivation, with 29% of hospitalizations among children living in counties at the highest deprivation being due ACSC conditions, compared to 25% among residents in the least deprived counties.

The Intersection of Residence and Area Deprivation

More sophisticated analysis that accounts for other important factors reveals a slightly different pattern (Figure 1). Within the least deprived counties, the likelihood of an ACSC hospitalization was significantly *lower* in rural counties than that observed among their urban counterparts. This rural advantage declines as the level of deprivation increases—mostly because the likelihood of an ACSC hospitalization increases in parallel with area deprivation in rural counties, while declining in urban. Increases in ACSC hospitalizations for both rural and urban counties were noted at the highest level of deprivation.

Figure 1: Predicted Probability of ACSC Hospitalization among children (<18 years of age) by Residence and Level of Deprivation (2011)



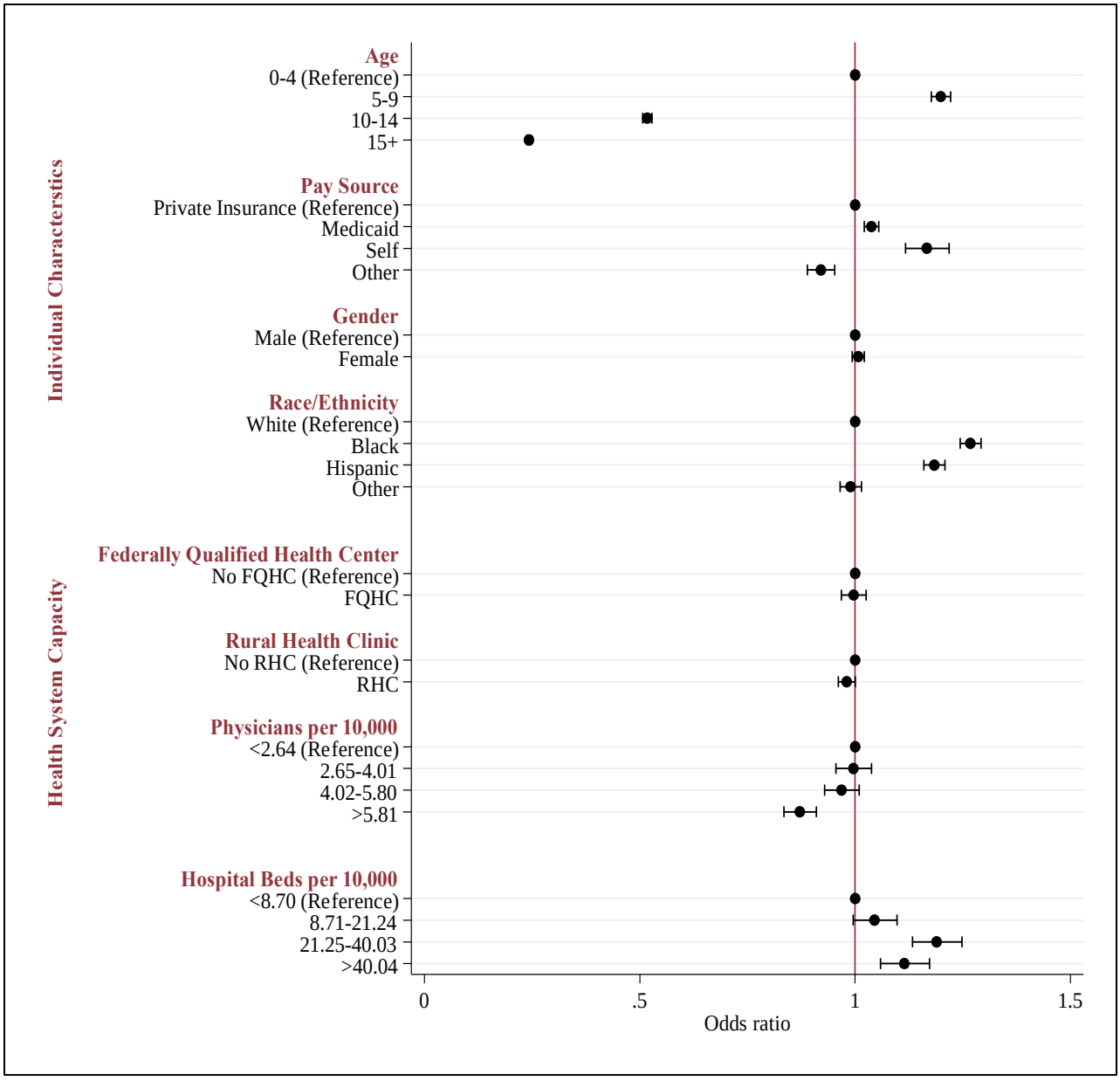
**Probabilities derived from a mixed model with fixed effects for rural, area deprivation, race/ethnicity, age, gender, pay source, transfer status, presence of a Federally Qualified Health Center or Rural Health Clinic, and the per capita number of physicians and hospital beds (10,000). Random effects for State were included in the model. Predicted probabilities were derived from the model using both fixed and random effects.*

As noted, ACSC hospitalization increased steadily across rural counties as the level of deprivation worsened—yet this was not the case for urban except at the highest level of deprivation. This pattern suggests the effect of rurality becomes more important as social and economic advantage deteriorates. Stated simply, the likelihood that children residing in urban communities were hospitalized for potentially avoidable conditions was largely unchanged across levels of area deprivation. This was not the case for rural communities. As area deprivation worsened, more rural children were hospitalized for potentially avoidable conditions.

Additional Findings of Interest

Differences in ACSC hospitalization by the characteristics of children and the capacity of the health systems where they reside are also worth noting (Figure 2). Black children and those of Hispanic ethnicity were more likely to be hospitalized for potentially avoidable conditions than their white counterparts. Children with Medicaid and those who were self pay (uninsured) were also more likely to be hospitalized for ACSC. Physician availability has some influence on the level of hospitalization from these conditions, with more physicians per capita being associated with lower ACSC hospitalization rates. Interestingly, the more hospital beds per capita in a county, the more likely children were to be hospitalized for ACSC. This finding is somewhat counter intuitive, but may reflect differences in patient volume and more complex patients accommodated by hospitals in more densely populated areas.

Figure 2: Adjusted Analysis for Additional Individual Characteristics and Measures of Health System Capacity (2011)



Summary and Policy Implications

Our nine-state study found that rural residence alone did not lead to more hospitalizations from potentially avoidable conditions among children. However, we did find that hospitalization rates from these conditions increased steadily in rural counties as the level of deprivation worsened. This was not the case in urban communities. These findings suggest that effect of social and economic disadvantage on hospitalizations from potentially avoidable conditions may be more detrimental in rural communities than in urban. Examining rurality alone may misrepresent the potential relationships between residence and selected outcomes when underlying levels of vulnerability are not well defined.

Current findings are consistent with other important research examining rural populations and factors contributing to observed differences in outcomes.[10,11] Examining trends in rural-urban mortality differences between 1969-2009, Singh & Siahpush noted the substantial rural-urban differences in life expectancy over time. These investigators also found poverty to have a significant impact on mortality within rural areas—noting a 6.2 year difference in the life expectancy between those residing in affluent rural areas compared to high poverty rural areas.[10] Findings from our study also suggest a gradient in selected outcomes as social and economic disadvantage progresses within rural communities.

At the individual level, we found the likelihood of an ACSC hospitalization to be much higher among racial/ethnic minority children and those with Medicaid or self-pay as an anticipated source of payment. These findings further contribute to the existing body of evidence documenting racial/ethnic disparities in important health related outcomes. Fortunately, ACSC hospitalizations remain a rare outcome event among children. When they do occur however, they can are serious and costly. The disproportionate burden among racial/ethnic minority children and for those with Medicaid or self-pay has important cost implications for families, state Medicaid agencies, and providers.

Policy Implications

The realized impact of the ACA on effective primary care delivery for children remains a salient point of discussion. The ability to characterize existing vulnerabilities of the primary care system for children and have metrics to monitor these changes over time is important. Existing coverage of children though Medicaid and Child Health Insurance Programs (CHIP) has largely leveled the rural-urban playing field with regard to insurance.[12] It is unlikely the demand for healthcare services from newly insured children will increase substantially with ACA implementation. However, the American Academy of Pediatrics (AAP) has noted that current pediatrician workforce is inadequate for rural and other underserved communities.[13] In the absence of pediatricians, children will be competing with previously uninsured adults also seeking healthcare services from a limited provider base. It is plausible that access to care for children could be adversely affected by these changes, particularly in rural and underserved communities.

Our findings also suggests that the existing primary care system is not structured to address the handicaps faced by high need communities and populations. Research directed at the Medicare population has found that community level approaches are key to reducing potentially preventable rehospitalizations.[3] Similar approaches, using community resources to identify and remedy gaps in parental education or access to health care services, are needed to reduce potentially preventable hospitalizations among children.

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Appendix: Tables & Technical Notes

Table 1: Bivarate Analysis and Unadjusted Odds Ratios for ACSC Hospitalizations by Residence and Level of Deprivation (2011)

	Hospitalization Type		
	Non ACSC	**ACSC**	
	n=347,409	n=116,882	
Total Sample	*74.8%*	*25.2%*	Odds Ratio (LBL-UBL)
Variable of Interest			
Residence			
Urban	74.7%	25.5%	Reference
Rural	75.9%	24.1%	0.93 (0.73-1.19)
Level of Deprivation			
Least	75.5%	24.5%	Reference
Not Very	77.0%	23.0%	0.92 (0.80-1.06)
Somewhat	76.8%	23.2%	0.93 (0.78-1.12)
Most	71.5%	28.5%	1.23 (1.13-1.33)

Table 2: Results from Multi-Level Model of ACSC Outcomes and Selected Covariates (2011)

	Odds Ratio	SE	p-value	95% Confidence Interval	
				Lower	Upper
Variable of Interest					
Residence / Area Deprivation					
Urban / Least Deprived	Ref				
Urban / Not Very Deprived	0.91	0.01	<0.001	0.89	.095
Urban / Somewhat Deprived	0.87	0.01	<0.001	0.84	0.89
Urban / Most Deprived	1.00	0.01	0.847	0.97	1.02
Rural / Least Deprived	0.81	0.04	<0.001	0.74	0.88
Rural / Not Very Deprived	0.86	0.03	<0.001	0.81	0.90
Rural / Somewhat Deprived	0.90	0.02	<0.001	0.86	0.94
Rural / Most Deprived	1.04	0.02	0.111	0.99	1.08
Rural/Urban Differences in Odds within Area Deprivation					
Least Deprived	0.81	0.04	<0.001	0.74	0.88
Not Very Deprived	0.94	0.02	0.009	0.89	0.98
Somewhat Deprived	1.04	0.02	0.074	1.00	1.08
Most Deprived	1.04	0.02	0.065	1.00	1.08

Definition of Rural

Child residence was measured at the county level. Rurality was defined using 2013 Urban Influence Codes (UIC), as follows: children residing in counties with UIC codes 1 and 2 were classified as urban, while those residing counties with UIC codes (3-12) were considered rural.

Additional Covariates of Interest

Additional individual characteristics and health system capacity measures were also included in the analysis. Individual factors were derived from the State Inpatient Database and include the child's age, race/ethnicity, gender, and expected source of payment. Health system capacity was measured at the county level and includes the presence of a Federally Qualified Health Center (FQHC), Rural Health Clinic (RHC), and the quartile distributions of physicians and hospital beds per capita (10,000). The quartile distribution of physicians and hospital beds were derived from the Area Health Resource File (AHRF) and reflect the position among all counties in the United States, not just the nine-state sample.

Statistical Analysis

A mixed model with both fixed and random effects was used to test influence of rurality and area deprivation on the odds of a pediatric hospitalization due to an ACSC within the sample. Of primary interest was the interaction of rurality and area deprivation. We specifically examined the effect of rurality within comparable levels of area deprivation. Fixed effects for rural, area deprivation, the interaction of rural and area deprivation, race/ethnicity, age, gender, pay source, transfer status, presence of a Federally Qualified Health Center or Rural Health Clinic, and the per capita number of physicians and hospital beds (10,000) were included in the model. Random effects for state were included in the model to account for unobserved heterogeneity at the state level. Predicted probabilities or marginal means were derived from the model incorporating both fixed and random effects in the estimates. All analysis was conducted using Stata version 12.