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Health Insurance and Length of Stay for Children Hospitalized With Community-Acquired Pneumonia

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Abstract

BACKGROUND—Disparities in patterns of care and outcomes for ambulatory-care sensitive childhood conditions such as community-acquired pneumonia (CAP) persist. However, the influence of insurance status on length of stay (LOS) for children hospitalized with CAP remains unexplored.

METHODS—Secondary analysis of children (<18 years) hospitalized with CAP sampled in the Kids' Inpatient Database (KID) for years 1997, 2000, 2003, and 2006. Insurance status (private, public, uninsured) was based on claims data. Hospital LOS was calculated in days. Taking into account the complex sampling design, negative binomial regression models produced adjusted estimates of incidence rate ratios (IRR) for hospital LOS for children by insurance status.

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RESULTS—There was little variation in the categories of insurance status of children hospitalized with CAP between 1997 and 2006, with at least 40% privately insured, at least 40% publicly insured, and at least 5% uninsured in each sampled year. In all years, publicly insured children had a significantly longer hospital stay than privately insured children, and uninsured children had a significantly shorter hospital stay than privately insured children. These observed differences persisted after multivariate adjustment.

CONCLUSIONS—Differences in LOS between uninsured, publicly insured, and privately insured children with CAP raise concerns about potential differences in hospital discharge practices related to insurance status and type. As healthcare reform is implemented, policy makers should strengthen efforts to reduce these disparities in order to achieve health for the population.

Disparities in patterns of care and outcomes for ambulatory-care sensitive conditions remain a persistent problem for children.[1–9] Many studies have focused on disparities in hospitalization rates and length of stay (LOS) related to asthma, however, few studies have focused on community-acquired pneumonia (CAP) despite the fact that pneumonia is the most common, preventable, and potentially serious infection in childhood.[10] Providers, payers, and families have a common interest in minimizing hospital LOS for different reasons (eg, minimizing costs, lost wages, exposure to antibiotic-resistant bacteria), however, this interest is balanced against the potentially greater risk of readmission and adverse outcomes if LOS is inappropriately short. To date, the relationship between insurance status and LOS for CAP remains unexplored.

As in other conditions, substantial variation exists with respect to patterns of care and outcomes for children hospitalized with CAP.[11] For example, children hospitalized in rural settings have a shorter LOS for pneumonia than those hospitalized in large urban settings. [12] Children from racial/ethnic minorities tend to have higher rates of CAP-associated complications, including death.[11] Decades of prior studies have documented that uninsured children are less likely than insured children to make preventive care visits and obtain prescription medications, but differences in LOS or hospitalization rates between insured and uninsured children with CAP have not been studied. [6,8,13,14] Though imperfect, insurance status is 1 proxy for healthcare access, and current healthcare reform efforts aim to improve healthcare access and decrease socioeconomic gradients in health by increasing the number of insured American children. Nonetheless, quantifying the relationship between insurance status on LOS for children hospitalized with CAP is a first step towards understanding the influence of ambulatory care access on hospitalization for ambulatory-care sensitive conditions.

The purpose of this study was to investigate the influence of insurance status and type on LOS for children hospitalized with CAP. In addition, we sought to determine if there were consistent trends over time in the association between insurance status and type with LOS for children hospitalized with CAP.

METHODS

Study Design and Data Source

This retrospective cross-sectional study used data from the 1997, 2000, 2003, and 2006 Kids' Inpatient Database (KID). The KID is part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality (AHRQ). It is the only dataset on hospital use and outcomes specifically designed to study children's use of hospital services in the United States. The KID samples pediatric discharges from all community non-rehabilitation hospitals in states participating in the Healthcare Cost and Utilization Project, using a complex stratification system, across pediatric discharge type

and hospital characteristics. Community hospitals in the KID are defined as "all non-federal, short-term, general and other specialty hospitals," including academic medical centers, obstetrics-gynecology, otolaryngology, orthopedic, and children's hospitals. Federal hospitals, long-term hospitals, psychiatric hospitals, alcohol/chemical dependency treatment facilities and hospitals units within institutions are excluded. Discharge-level weights assigned to discharges within the stratum permit calculation of national estimates. Datasets, which each contain approximately 3 million discharges (unweighted), are released every 3 years beginning with 1997. The 2006 KID is the most recently available dataset and contains hospital administrative data from 38 states, representing 88.8% of the estimated US population. [15] This study was considered exempt from review by the Committees for the Protection of Human Subjects at The Children's Hospital of Philadelphia.

Study Participants

Patients 18 years of age and younger were eligible for inclusion if they required hospitalization for CAP in 1997, 2000, 2003, or 2006. Using a previously validated algorithm, patients were considered as having CAP if they met 1 of 2 criteria: 1) International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9 CM) primary diagnosis code indicating pneumonia (480–483, 485–486), empyema (510), or pleurisy (511.0–1, 511.9); or 2) primary diagnosis of pneumonia-related symptom (eg, cough, fever, tachypnea) and secondary diagnosis of pneumonia, empyema or pleurisy. Pneumonia-related symptoms included fever, respiratory abnormality unspecified, shortness of breath, tachypnea, wheezing, cough, hemoptysis, abnormal sputum, chest pain, and abnormal chest sounds.[16] Because there is no specific ICD-9 code for nosocomial pneumonia, this previously validated approach minimized such misclassification[16] (eg, a child hospitalized following traumatic injury who then develops ventilator-associated pneumonia is likely to have trauma, rather than pneumonia or a pneumonia-related symptom, listed as the primary diagnosis). Patients with the following comorbid conditions (identified by KID data elements and ICD-9 CM codes) were excluded as these comorbidities are characterized by risk factors not reflective of the general pediatric population: acquired and congenital immunologic disorders, malignancy, collagen vascular disease, sickle cell disease, cystic fibrosis, organ transplant, congenital heart defects, and heart failure. Patients identified as in-hospital births were excluded to minimize the inclusion of perinatally acquired and nosocomial infections occurring in neonates. Patients with a secondary diagnosis code indicating trauma were also excluded, as a diagnosis of pneumonia in this population likely reflects nosocomial etiology. CAP-related complications (eg, effusion, abscess; for complete list, see Supporting Appendix A in the online version of this article) were identified using ICD-9 CM diagnosis and procedure codes. Asthma-related hospitalizations were identified using ICD-9 CM diagnosis code 493 in any secondary diagnosis field.

Primary Exposure

The primary exposure was insurance type, categorized as private, public, uninsured, or other (eg, Civilian Health and Medical Program Uniform Service (CHAMPUS), worker's compensation, union-based insurance, but definition varies by state precluding categorization as purely public or private).

Primary Outcome

The primary outcome was the hospital LOS calculated in days.

Statistical Analysis

Consistent with prior work,[12] subjects were characterized by age, race, sex, the presence or absence of a pneumonia-associated complication, discharge status (discharge from hospital vs in-hospital death), hospital type (rural, urban non-teaching, urban teaching non-children's, urban teaching children's), and hospital region (Northeast, Midwest, South, West). Age groups for analysis were defined as <1 year (infant), 1 to 5 years (preschool age), 6 to 11 years (school-age), and 12 to 18 years old (adolescent). Race was recorded as a single variable (white, black, other, and missing). Patient information for race was missing from 32% of discharges in 1997, 18% in 2000, 29% in 2003, and 26% in 2006. Patients with missing race data were included to preserve the integrity of our estimates. Categorical variables were summarized by frequencies and percents. Continuous variables were summarized by mean and standard deviation values.

All analyses accounted for the complex sampling design with the survey commands included in STATA, version 10 (College Station, TX) to produce weighted estimates. To determine the adjusted impact of patient and hospital-level characteristics in our cohort, we constructed multivariable negative binomial regression models using all available covariates for LOS because of its rightward-skewed distribution. The negative binomial model produced an incident rate ratio (IRR) for LOS (IRR >1 indicates that the risk factor is associated with a longer length of stay). As recommended in the AHRQ technical documentation, variance estimates for each model accounted for the clustering of data at the hospital level. To address the impact of missing race data on outcome, we constructed additional multivariable negative binomial regression models while varying the underlying assumptions about race classification. In these secondary analyses, children with race coded as missing were sequentially excluded, assumed to be white, and assumed to be black. These analyses were repeated after excluding insurance from the multivariable model.

RESULTS

The more than 10.5 million children sampled (unweighted) in KID during these 4 time periods (1997, 2000, 2003, and 2006) are representative of the more than 28.9 million children hospitalized in the United States. In each of these sample years, there were approximately 150,000 children hospitalized with pneumonia across the United States (Table 1). Of those hospitalized, 23% to 28% had a concomitant diagnosis of asthma; 6% to 8% had a pneumonia-associated complication; and mortality was <0.01% in each sample year for patients hospitalized with pneumonia. In all years, among those with racial/ethnic data, the sample population was predominantly white boys less than 6 years old. The greatest proportion of children were hospitalized in urban non-teaching settings, and also those children living in the southern regions of the United States.

There was little variation in the insurance status of children hospitalized with CAP between 1997 and 2006. In each of the sampled years, at least 40% of sampled children were privately insured, at least 40% were publicly insured, and approximately 5% were uninsured (Table 1). In all years, there were significant racial/ethnic disparities in insurance coverage such that whites were 4 to 6 times more likely to have private insurance than blacks, however, the large amount of missing race/ethnicity data warrant caution in interpreting this finding (Table 2; also see Supporting Information Appendix B in the online version of this article). We also found that children less than 1 year old were the most likely to be publicly insured in all years (see Supporting Appendix C in the online version of this article). There were also regional differences related to insurance coverage such that a greater proportion of children hospitalized in facilities located in the southern part of the United States were publicly insured. Notably, there were no significant differences in CAP-associated mortality or asthma related to insurance coverage (Table 2). In 2006, CAP-associated complications

occurred in 8.5% of children with private insurance, 6.5% of children with public insurance, and 7.7% of uninsured children; the relative distribution of complications by insurance type were similar in previous years of the KID survey.

After examining the general and demographic characteristics, we then examined mean LOS for all children with CAP in each sample year (Table 3). The mean LOS for children with CAP was 3.44 days in 1997, with marginal decreases in subsequent years to a mean LOS of 3.18 days in 2006. The distribution of LOS for children with CAP revealed that nearly 70% of children were hospitalized for fewer than 3 days, another 22% to 28% were hospitalized for less than 1 week, and only 3% were hospitalized for more than 1 week. This distribution did not change substantially between 1997 and 2006. Next, we compared mean LOS by insurance type and race/ethnicity in unadjusted analyses. In each sample year, publicly insured children hospitalized with CAP had significantly longer LOS than privately insured children ($P < 0.001$). Similarly, in all years excepting 1997, uninsured children hospitalized with CAP had significantly shorter LOS than privately insured children. There were also significant racial differences in LOS for children with CAP, such that black children had longer LOS than white children with CAP. However, the large amount of missing data for race/ethnicity limited the robustness of this finding, and subsequent sensitivity analyses demonstrated that there were no consistent racial/ethnic disparities in LOS (see Supporting Appendix B in the online version of this article). These sensitivity analyses for missing race data did not alter our primary finding of shorter LOS for uninsured versus publicly or privately insured children.

After controlling for child age, race/ethnicity, gender, hospital type, transfer status, and presence of asthma or pneumonia-associated complications, our multivariable analyses examining the relationship between insurance coverage and hospital LOS yielded the following results (Table 4). First, publicly insured children had significantly longer hospital stays than privately insured children, and uninsured children had significantly shorter hospital stays than privately insured children in all years except 1997. Second, children admitted with CAP at urban teaching children's hospitals had significantly longer LOS than those admitted to urban non-teaching hospitals, and, in 2003, children admitted with CAP to rural hospitals had significantly shorter LOS than those admitted to urban non-teaching hospitals. Third, children older than 1 year consistently had shorter hospital stays than infants less than 1 year old. Finally, though concomitant diagnosis of asthma did not consistently influence LOS, children who developed any complications had significantly longer LOS than those who did not. The cumulative impact of seemingly small differences in LOS is great. For example, in 2006, our model suggests that, for every 1000 children hospitalized with CAP in a given year, after adjusting for differences in sex, age, race, hospital-type, region, transfer status, and diagnosis of asthma or complications, publicly insured children spend 90 to 130 more days in the hospital than privately insured children, whereas uninsured children spend between 40 to 90 fewer days in the hospital than privately insured children.

DISCUSSION

In this nationally representative sample selected over the past 10 years, we found that publicly insured children hospitalized with CAP have significantly longer LOS than those who are privately insured, and that, since 2000, uninsured children hospitalized with CAP have significantly shorter LOS than those who are privately insured. Though these observed differences are small, they are consistent across all 4 sampled years and, because CAP is one of the most common pediatric inpatient diagnoses, the cumulative impact of the observed differences on hospital LOS is great. Insurance status is often considered a proxy for access to preventive and ambulatory healthcare services or socioeconomic status. However, the

underlying mechanisms relating insurance status to healthcare access, utilization, and ultimately, health outcomes are highly complex and difficult to elucidate.[17] The observed variation in this study raises questions about the potential influence of insurance status on hospital discharge practices. Additional research is necessary to understand whether there are differences in processes of care (eg, performance of blood cultures or chest radiographs), quality of care, or other outcomes, such as readmissions, related to CAP inpatient management for children with different insurance coverage.

Apart from differences in hospital discharge practices, another possible explanation for uninsured children with CAP having shorter LOS is that these children have less severe disease than privately insured. This may occur if uninsured children with CAP are evaluated in the emergency department rather than the office setting, because emergency department providers may be more likely to admit children with CAP who lack a consistent access to ambulatory primary care services. Countering this alternative, prior studies have shown that uninsured groups are more likely to have greater disease severity than privately insured groups at the time of hospital admission.[18,19] In this study, we attempted to identify children with greater severity of disease using ICD-9 codes for CAP-associated complications. Though this is a relatively crude method that might lead to an underestimate of the total number of children with complications, we found that there were no significant differences in the prevalence of CAP-associated complications between uninsured and insured groups in all sampled years.

On the other hand, uninsured patients may be released earlier by providers in order to reduce the amount of uncompensated care provided, or possibly because parents may urge providers to discharge their children, given their inability to pay forthcoming hospital bills and/or avoid further lost wages due to work absence.[20,21] In California, Bindman et al. demonstrated that decreasing the frequency of Medicaid recertification, and consequently increasing the likelihood of continuous insurance coverage, was associated with a decreased risk of hospitalization for ambulatory-care sensitive conditions.[5]

We also found that children admitted to urban teaching children's hospitals with CAP had significantly longer LOS than those admitted to urban non-teaching hospitals, whereas children in rural hospitals had significantly shorter LOS than those in urban non-teaching hospitals in 2003. These findings are consistent with prior data from 1996 to 1998 demonstrating that children admitted to rural hospitals in New York and Pennsylvania had significantly shorter LOS than large urban hospitals for 19 medical and 9 surgical conditions, including pneumonia.[12] These findings may reflect underlying differences in between rural and urban hospital transfer practices, whereby rural hospitals may be more likely than urban hospitals to transfer children with relatively more severe illness to urban referral centers and retain children with less severe illness, leading to shorter LOS.[12] Though our empiric understanding of differences in LOS between teaching and non-teaching hospitals is currently limited, clinical experience supports the notion that there may be decreases in efficiency that occur in teaching hospitals, and are a result of the supervision required for care provided by trainees. It is also possible that, despite our exclusion of comorbid conditions, some children with complex or chronic medical conditions were included in this study. These children are often cared for at teaching hospitals, regardless of the primary cause for admission, and are more likely to have public insurance than other children, thus confounding the relationship between hospital type, insurance type and status, and LOS for children with CAP. The limitations of this dataset preclude further examination of this issue.

There are some limitations to this study. First, the KID data are cross-sectional and causal inferences are limited. However, our results demonstrating that uninsured children

hospitalized with CAP had shorter LOS than privately insured children were quite consistent in each sample year, suggesting that our results are a true association. Additionally, insurance status in KID is typically collected at admission, however, it is not possible to determine whether specific changes to insurance status that occurred during the hospitalization were applied to the data. The impact of this limitation would depend on the type of insurance obtained by the patient. If uninsured patients obtained public insurance, our study would underestimate the increased LOS for publicly insured patients, compared with privately insured patients, but have no effect on the difference in LOS between uninsured and privately insured patients. In the unlikely event that uninsured patients obtained private insurance, then our study would underestimate the difference for uninsured patients, compared with privately insured patients, biasing our current study results towards the null. Second, a substantial proportion of sampled children had missing data for race/ethnicity. To assess the impact of the missing race/ethnicity data on our results, we conducted sensitivity analyses and found that, though difficult to make any definitive conclusions about the relationship between race/ethnicity and LOS for children with CAP, there were no changes to our primary findings regarding differences in LOS between children with different insurance status and type. Third, KID does not include data about other unmeasured confounders (eg, parent income, parent education, regular source of care) that might be related to LOS, as well as a broad spectrum of pediatric outcomes. Serious consideration of expanding KID to include these variables is warranted. Fourth, the “other” category of insurance is not uniformly coded across states in the KID database. While some states use this category to classify public insurance options other than Medicare and Medicaid, other states include private insurance options in this group. Thus, it is possible that some patients with public insurance are misclassified as having “other” insurance. We would expect such misclassification to bias our findings towards the null hypothesis. Finally, we focused on the relationship between child health insurance status and CAP, only 1 ambulatory care-sensitive condition. Additional research examining the relationship between insurance type and other ambulatory care-sensitive conditions is warranted.

In summary, we found that, after multivariable adjustment, uninsured children hospitalized with community-acquired pneumonia had significantly shorter LOS than privately insured children, and publicly insured children had a significantly longer hospital stay than privately insured children in these 4 nationally representative samples from 1997 to 2006. Current federal and state efforts to increase enrollment of children into insurance programs are a first step in reducing healthcare disparities. However, insurance coverage alone does not guarantee access to healthcare, thus, these efforts in isolation will likely be insufficient to achieve optimal health for the children of our country. As healthcare reform legislation is implemented, these findings provide hospitals and policy makers additional impetus to develop ways to achieve the “ideal” length of stay for every child; this ideal state will be achieved when clinical status and course, rather than nonclinical factors such as insurance type or provider’s unease with ambulatory follow-up, determine the duration of hospitalization for every child.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of Children Hospitalized With Pneumonia in the United States

	1997 N = 148,702	2000 N = 157,847	2003 N = 157,743	2006 N = 156,810
Race				
White	56,348 (38)	68,643 (44)	54,903 (35)	56,108 (36)
Black	22,864 (15)	22,580 (14)	17,960 (11)	18,800 (12)
Other	22,203 (15)	38,448 (24)	39,138 (25)	40,803 (26)
Missing	47,287 (32)	28,175 (18)	45,588 (29)	41,099 (26)
Age category				
<1 year	43,851 (29)	44,470 (28)	37,798 (24)	37,705 (24)
1 through 5 years	75,033 (50)	76,385 (48)	77,530 (49)	79,519 (51)
6 through 11 years	19,372 (13)	21,403 (14)	23,126 (15)	23,494 (15)
>12 years	10,446 (7)	15,589 (9)	19,289 (12)	16,092 (10)
Hospital type				
Urban non-teaching	52,756 (35)	50,718 (32)	52,552 (34)	50,718 (32)
Rural	47,910 (32)	41,715 (27)	39,605 (26)	31,947 (21)
Urban teaching non-children's	20,378 (14)	30,981 (20)	28,432 (18)	30,194 (20)
Urban teaching children's	27,658 (19)	34,021 (22)	34,454 (22)	41,035 (27)
Male sex	83,291 (56)	8,783 (56)	86,034 (55)	85,508 (55)
Region*				
Northeast	19,750 (13)	26,092 (17)	23,867 (15)	23,832 (15)
Midwest	33,053 (22)	30,706 (19)	35,714 (23)	35,900 (23)
South	68,958 (46)	68,663 (44)	65,994 (42)	65,460 (42)
West	26,741 (18)	32,385 (21)	32,169 (20)	31,618 (20)
Asthma	26,971 (24)	31,746 (28)	27,729 (24)	26,822 (23)
Pneumonia-associated complication	8,831 (6)	11,084 (7)	12,005 (8)	11,724 (7)
Died	334 (0.002)	394 (0.002)	270 (0.002)	193 (0.001)
Insurance				
Private	65,428 (44)	73,528 (47)	68,720 (44)	63,997 (41)
Public	68,024 (46)	71,698 (45)	76,779 (49)	80,226 (51)
Uninsured	9,922 (7)	8,336 (5)	6,381 (4)	6,912 (4)
Other	4,964 (3)	4,285 (3)	5,391 (3)	5,283 (3)

NOTE: Values, which represent national estimates, are listed as number (percent). Numbers across rows may not sum exactly because weighted estimates from these data are obtained using survey commands as per KIDS technical guidance.[15]

*KID categorizes states into the following 4 regions: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming).

TABLE 2

Demographic Characteristics of Children Hospitalized With Pneumonia in 2006, Stratified by Insurance Category

	Private	Public	Uninsured	Other Insurance	*P*
No. of children (%)	63,997 (41)	80,226 (51)	6,912 (4)	5,283 (3)	…
Male sex	34,639 (41)	44,140 (52)	3,727 (4)	2,808 (3)	0.092
Race					
White	30,707 (55)	21,282 (38)	2,241 (4)	1,774 (3)	<0.001
Black*	5,112 (27)	12,239 (65)	988 (5)	426 (3)	
Other	11,033 (27)	26,489 (65)	2,112 (5)	1,076 (3)	
Missing	17,145 (42)	20,216 (49)	1,572 (4)	2,007 (4)	
Age category					
<1 year	10,788 (29)	24,762 (65)	1,164 (3)	880 (3)	<0.001
1 through 5 years	33,664 (42)	39,531 (50)	3,442 (4)	2,673 (3)	
6 through 11 years	11,660 (50)	9,684 (41)	1,085 (5)	1,015 (4)	
>12 years	7,885 (49)	6,249 (39)	1,221 (8)	714 (4)	
Hospital type					
Urban non-teaching	22,429 (44)	24,241 (49)	2,440 (5)	1,555 (2)	<0.001
Rural†	10,880 (34)	18,396 (58)	1,290 (4)	1,109 (3)	
Urban teaching non-children's‡	13,130 (44)	14,542 (48)	1,721 (6)	750 (2)	
Urban teaching children's§	16,591 (40)	21,544 (53)	1,417 (3)	1,465 (4)	
Region					
Northeast	12,364 (52)	9,620 (40)	1,466 (6)	377 (2)	<0.001
Midwest‖	17,891 (50)	15,573 (43)	1,160 (3)	1,215 (3)	
South‖	21,479 (33)	38,112 (58)	3,108 (5)	2,495 (4)	
West‖	12,263 (39)	16,921 (44)	1,178 (5)	1,195 (5)	
Asthma	10,829 (41)	13,923 (52)	1,119 (4)	866 (3)	0.193
Pneumonia-associated complication	5,416 (46)	5,206 (45)	532 (4)	556 (5)	<0.001
Died	66 (34)	115 (60)	3 (1)	8 (5)	0.131

NOTE: Chi-square test used to compare differences. Numbers across rows may not sum exactly because weighted estimates from these data are obtained using survey commands as per KIDS technical guidance.[15] For data from other years (1997, 2000, 2003), see Supporting Appendix C in the online version of this article.

*$P < 0.001$ compared with white race.

†$P < 0.001$ compared with urban non-teaching hospitals.

‡$P = 0.384$ compared with urban non-teaching hospitals.

§$P = 0.004$ compared with urban non-teaching hospitals.

||$P < 0.001$ compared with Northeast region.

TABLE 3

Unadjusted Length of Stay Overall and Stratified by Insurance Type and Race Category

	1997	*P*	2000	*P*	2003	*P*	2006	*P*
Overall	3.44 (0.04)		3.35 (0.05)		3.27 (0.05)		3.18 (0.04)	
Insurance type								
Private	3.21 (0.04)	…	3.19 (0.04)	…	3.09 (0.04)	…	3.00 (0.03)	…
Public	3.71 (0.06)	<0.001	3.57 (0.06)	<0.001	3.44 (0.06)	<0.001	3.34 (0.05)	<0.001
Uninsured	3.18 (0.14)	0.792	2.92 (0.07)	<0.001	2.80 (0.05)	<0.001	2.82 (0.05)	<0.001
Other	3.32 (0.11)	0.319	3.55 (0.14)	0.0134	3.54 (0.21)	0.037	3.42 (0.13)	0.001
Race								
White	3.31 (0.05)	…	3.18 (0.04)	…	3.19 (0.05)	…	3.10 (0.04)	…
Black	3.61 (0.08)	<0.001	3.32 (0.07)	<0.001	3.36 (0.08)	<0.001	3.31 (0.07)	<0.001
Other	3.96 (0.11)	<0.001	3.81 (0.09)	<0.001	3.67 (0.10)	<0.001	3.56 (0.08)	<0.001
Missing	3.27 (0.08)	0.645	3.18 (0.08)	0.926	2.99 (0.06)	0.0134	2.86 (0.04)	<0.001

NOTE: Values listed as mean length of stay (standard error). Wald test used to compare differences in mean length of stay with designated reference group.

TABLE 4

Multivariable Negative Binomial Regression Model of Factors Associated With Length of Stay

Variable	1997 IRR (95% CI)	2000 IRR (95% CI)	2003 IRR (95% CI)	2006 IRR (95% CI)
Age category				
<1 year	…	…	…	…
1–5 years	0.82 (0.81, 0.84)‡	0.83 (0.88, 0.95)‡	0.86 (0.85, 0.88)‡	0.87 (0.86, 0.89)‡
6–11 years	0.91 (0.87, 0.95) ‡	0.91 (0.88, 0.94)‡	0.93 (0.91, 0.95)‡	0.93 (0.90, 0.95)‡
>12 years	1.03 (0.99, 1.07)	1.17 (1.11, 1.22)‡	1.09 (1.06, 1.13)‡	1.13 (1.09, 1.16)‡
Race				
White	…	…	…	…
Black	1.04 (0.99, 1.08)	1.00 (0.95, 1.03)	1.00 (0.98, 1.03)	1.02 (0.98, 1.06)
Other	1.09 (1.05, 1.13)†	1.11 (1.08, 1.15)‡	1.09 (1.06, 1.12)‡	1.08 (1.05, 1.11)‡
Missing	1.00 (0.94, 1.06)	1.01 (0.96, 1.06)	0.95 (0.92, 0.99)*	0.96 (0.93, 0.99)†
Sex				
Female	1.02 (0.94, 1.06)	1.01 (0.99, 1.02)	1.01(0.93, 100)	1.01 (1.00, 1.02)
Insurance type				
Private	…	…	…	…
Public	1.13 (1.11, 1.16)‡	1.11 (1.09, 1.14)‡	1.11 (1.09, 1.13)‡	1.11 (1.09, 1.13)‡
Uninsured	1.01 (0.91, 1.11)	0.93 (0.89, 0.96)‡	0.92 (0.90, 0.96)‡	0.94 (0.91, 0.96)‡
Other	1.01 (0.96, 1.06)	1.10 (1.03, 1.18)†	1.10 (1.02, 1.19)*	1.07 (1.02, 1.13)†
Hospital type				
Urban non-teaching	…	…	…	…
Rural	0.98 (0.92, 1.04)	0.96 (0.92, 1.00)	0.97 (0.94, 1.00)†	0.97 (0.93, 1.00)
Urban teaching (non-children's)	0.99 (0.95, 1.04)	1.06 (1.02, 1.10)†	1.06 (1.02, 1.10) ‡	1.03 (0.99, 1.07)
Urban teaching children's	1.2 (1.14, 1.26)‡	1.23 (1.16, 1.30)‡	1.28 (1.21, 1.37)‡	1.25 (1.19, 1.31)‡
Region				
Northeast	…	…	…	…
Midwest	0.93 (0.88, 0.98)*	0.96 (0.92, 1.00)	0.95 (0.91, 0.99)*	0.95 (0.91, 0.99)*
South	0.98 (0.94, 1.02)	1.06 (1.02, 1.10)*	1.04 (1.00, 1.09)	1.03 (0.98, 1.08)
West	0.97 (0.92, 1.01)	1.22 (1.16, 1.30)*	1.02 (0.97, 1.08)	1.06 (1.00, 1.12)*
Transfer status				
Transfer	1.35 (1.25, 1.46)‡	1.39 (1.27, 1.52)‡	1.31 (1.23, 1.37)	1.16 (1.10, 1.23)‡
Asthma	0.99 (0.96, 1.03)	0.97 (0.95, 0.99)†	0.98 (0.96, 1.00)	0.98 (0.97, 1.00)*
Pneumonia Complications	0.99 (0.96, 1.03)	0.97 (0.95, 0.99)*	0.98 (0.96, 1.0)	0.98 (0.97, 1.00)*
Any complication	2.20 (2.07, 2.34)‡	2.23 (2.07, 2.40)‡	2.22 (2.22, 2.44)‡	2.37 (2.27, 2.47)‡

NOTE: All available variables included in multivariable models. KID categorizes states into the following 4 regions: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington,

Wyoming). **Abbreviations:** CI, confidence interval; IRR, incidence rate ratio. Significant values are noted as follows; all other values are not significant:

* $P < 0.05$;

† $P < 0.01$;

‡ $P < 0.001$.