

# Characteristics of Low-Severity Emergency Department Use Among CHIP Enrollees

Justin Blackburn, PhD; David J. Becker, PhD; Bisakha Sen, PhD; Michael A. Morrissey, PhD; Cathy Caldwell, MPH; and Nir Menachemi, PhD, MPH

**F**rom 1997 through 2007, emergency department (ED) visits in the United States increased by 23%, or 11% per capita.<sup>1</sup> Many of these ED visits were for low-severity conditions and potentially could have been avoided with the provision of effective primary care.<sup>2,3</sup> These visits increase ED overcrowding, wait times, and financial strain on public health insurance programs.<sup>2,4</sup>

Use of ED services for low-severity conditions is often interpreted as a marker of a failing primary care delivery system. The reliance on ED care may result from limited access to other, less intensive care settings,<sup>5</sup> either because of geography, insurance coverage, or other psychosocial factors.<sup>6,7</sup> Low-severity ED visits often result from the inability of patients to obtain swift “reassurance” or advice in the primary care setting.<sup>8,9</sup> Reducing barriers to primary care could reduce low-severity ED utilization and downstream costs through improved prevention and management. For instance, children with greater continuity of primary care have fewer hospitalizations and ED visits.<sup>10</sup> Furthermore, access to high-quality primary care, as defined by Consumer Assessment of Healthcare Providers and Systems surveys, is associated with lower ED utilization for low-severity conditions among Medicaid children.<sup>11</sup>

There is a sizable literature examining the individual characteristics associated with low-severity ED visits. For example, previous research among pediatric populations suggests that low-severity ED visits are more common among nonwhites,<sup>12,13</sup> rural residents,<sup>13</sup> individuals with low socioeconomic status,<sup>14</sup> and those lacking access to primary care.<sup>12,13</sup> Although research has shown that adult Medicaid enrollees are more likely to use the ED for low-severity conditions,<sup>15</sup> less is known about the predictors of low-severity ED utilization among the publicly insured, especially children.

This study investigates the characteristics of enrollees in ALL Kids (Alabama’s Children’s Health Insurance Program [CHIP]) who utilized ED services for low-severity conditions. An improved understanding of the determinants of low-severity ED visits holds the key to better designing a system that targets unnecessary utilization of an expensive and scarce resource. Given prior literature, predictors of limited access to primary care (eg, nonwhite race, rural residence, weekend visit) were hypothesized to be associated with children’s visits to the ED for low-severity conditions.

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**Objectives:** To describe patient characteristics among those utilizing the emergency department (ED) for low-severity conditions (ie, conditions potentially treatable or manageable in a primary care setting).

**Study Design:** A pooled cross-sectional study of administrative claims for ED visits among enrollees in Alabama’s Children’s Health Insurance Program (CHIP), ALL Kids, from January 1, 1999, through December 31, 2010.

**Methods:** Severity of visit was categorized based on primary diagnosis code using an established claims-based algorithm. Logistic regression was used to identify patient characteristics that predicted low-severity ED visits relative to high-severity visits.

**Results:** Of a total of 141,709 qualifying ED visits, 97,961 (69%) were classified as low severity, 33,941 (24%) as intermediate severity, and 9807 (7%) as high severity. Based on absolute risk differences, we found that among children utilizing the ED, low-severity visits were more likely than high-severity visits among children who were noncompliant with recommended well-child care (1.2 percentage points, 95% confidence interval [CI], 0.4-1.9); children who were nonurban residents (urban vs isolated: 1.6 percentage points, 95% CI, 1.0-2.2; urban vs small rural: 1.1 percentage points, 95% CI, 0.5-1.7); children without chronic disease (10.3 percentage points, 95% CI, 9.9-10.7) and children whose ED visits were on Sunday versus weekdays (0.9 percentage point, 95% CI, 0.6-1.3), and on Saturday versus weekdays (1.2 percentage points; 95% CI, 0.8-1.6).

**Conclusions:** Our results suggest that improving access to primary care on weekends and in rural areas are potential ways to improve the efficient use of ED services.

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**For author information and disclosures, see end of text.**

### Take-Away Points

We investigated whether emergency department (ED) use for low-severity conditions among low-income children was associated with modifiable characteristics using claims data from a Children's Health Insurance Program that is similar to private insurance. We found that among children having a visit to the ED:

- Older age, male sex, African American race, presence of chronic disease, and compliance with recommended well-child care were associated with decreased likelihood of low-severity visits (relative to high-severity visits).
- Living in an isolated rural town and visits on weekend days were associated with increased likelihood of low-severity visits (relative to high-severity visits).

We used the method developed by Wharam and colleagues<sup>18</sup> to convert the NYU severity category probabilities into a single-dimensional measure of severity. This approach used the sum of the probabilities for the 2 categories in which ED care is needed to assign visits to 1 of 3 severity categories: high severity (>75% probability that ED care was needed); intermediate severity (25%-75% probability that ED care was needed); and low severity (<25% probability that ED care was needed). The severity category groupings utilized in this study have been associated with subsequent hospitalizations and death.<sup>18</sup>

## MATERIALS AND METHODS

### Study Design and Population

This study utilized a pooled cross-sectional design. The study population comprised enrollees in ALL Kids, Alabama's CHIP. ALL Kids covers legal Alabama residents younger than 19 years with family incomes from 101% to 200% of the federal poverty level (FPL). In 2010, eligibility was expanded to children living in families with incomes of 300% of the FPL. Alabama is 1 of 15 states with a free-standing CHIP that operates independently of the Alabama Medicaid program and provides enrollees with access to a more extensive private insurance provider network.<sup>16</sup> Children enrolled in ALL Kids benefit from full medical, pharmaceutical, and dental coverage from the Blue Cross Blue Shield of Alabama (BCBSAL) preferred provider network. Enrollees pay an annual premium and copayments for various services. The unit of analysis in this study was claims from ED visits from 1999 to 2010, during which 299,906 unique children were enrolled in the ALL Kids program. This study received approval from the University of Alabama at Birmingham Institutional Review Board for Human Use.

### Classifying ED Visits

Revenue center codes 450 through 459 were used to identify ED visits from medical claims. ED visits resulting in hospitalization were excluded. The ED physician's primary *International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis code was then used to classify each visit by severity based on an algorithm developed at New York University (NYU) by Billings and colleagues.<sup>17</sup> The original NYU algorithm assigned every ED visit a probability of belonging to each of 4 severity categories: (1) non-emergent, (2) emergent/primary care treatable, (3) emergent/ED care needed, and (4) emergent/ED care needed, not preventable/avoidable. Injuries and conditions requiring specialty care (eg, those related to drugs, alcohol, or mental health) were excluded from the 4 categories. Some ICD-9-CM diagnosis codes were not included in the original algorithm, and ED visits for these conditions were excluded from our analysis.

that ED care was needed). The severity category groupings utilized in this study have been associated with subsequent hospitalizations and death.<sup>18</sup>

### Definition of Characteristic Variables

The BCBSAL claims data and enrollment files provided information regarding enrollees' demographic characteristics including age, sex, zip code of residence, and cost-sharing group that corresponds to their FPL: low-fee group (101%-150% of FPL); fee group (151%-200% of FPL); and those whose family income is 200% to 300% of FPL. A federally exempt group, primarily children of Native American descent, is considered the no-fee group. Data obtained from BCBSAL contained adjudicated claims, fewer than 3% of which contained missing or problematic data such as nonunique identifiers; these data were excluded. Other data collected by ALL Kids during the application process were used to determine enrollee's race and were merged with the BCBSAL enrollee data. Rural status was determined from the zip code of residence, which was converted to Rural Urban Commuting Area (RUCA) codes using the zip code approximation method and subsequently categorized into 4 levels: urban focused, large rural city/town focused, small rural town focused, and isolated small rural town focused.<sup>19</sup> Chronic disease status was determined by the presence of any condition that might involve extensive ongoing management, including human immunodeficiency virus infection, cancer, anemia or coagulation disorders, diabetes, cystic fibrosis, schizophrenic disorders, developmental disorders, infantile cerebral palsy, epilepsy, muscular dystrophy, heart and circulatory diseases or defects, asthma, rheumatoid arthritis, spina bifida, birth trauma, spinal cord injury, and hearing loss.<sup>20</sup>

As a proxy for access to primary care, the proportion of children in each zip code receiving well-child care consistent with the Healthcare Effectiveness Data and Information Set (HEDIS) recommendation in the previous year was calculated using data from the complete ALL Kids enrollment and claims files. The HEDIS criteria are defined for the first 15 months of life, age 3 to 6 years, and age 12 years and older.<sup>21</sup> To simplify,

the current analysis defined appropriate well-child care as 6 well-child visits within the first 15 months of life and at least 1 visit for children aged 2 years to 19 years. This area-level measure captured access within the geographical area and did not suffer from the endogeneity of individual-specific adherence to the HEDIS guidelines. Quartiles based on the proportion of children in each zip code meeting the measure were defined as fewer than 22.3% for very low, 22.4% to 33.5% for low, 33.6% to 44.1% for intermediate, and 44.2% or more for high.

**Statistical Methods**

All analyses were performed using STATA/MP release 12.1 for Windows (StataCorp LP, College Station, Texas). The bivariate associations between patient characteristics and ED use were assessed using cross-tabs (all covariates were categorical) with statistical significance determined using a  $\chi^2$  statistic. Next, we used multivariate logistic regression to identify the independent effect of individual characteristics on the use of ED services for low-severity versus high-severity conditions. These regressions allowed us to observe differences in patient characteristics between the low-severity and the high-severity ED populations.

We present odds ratios and 95% confidence intervals (CIs) from the logistic regressions for each covariate. However, given the well-known problems of misinterpreting odds ratios when the outcome is not “rare,”<sup>22,23</sup> we also calculated and present marginal effects—also known as absolute risk differences—associated with that covariate (henceforth, marginal effects will be referred to as risk differences). Essentially, risk differences capture the impact of the covariate on the predicted probability of the outcome compared with the reference category. The magnitude is in the natural metric, percentage points, and represents the slope of the logistic curve evaluated at the sample mean. Standard errors for the risk differences were calculated from the standard errors for the underlying beta coefficients using the delta method. We estimated Huber/White heteroscedasticity-consistent standard errors using a variance-covariance matrix that allows for correlated errors (clustering) among individuals with repeated visits.<sup>24</sup>

**RESULTS**

A total of 251,480 visits to the ED were identified during the study period. Mental health, alcohol, and drug-related visits (n = 1028) represented 0.4% of claims and were excluded. Visits for which the diagnosis was unclassifiable by the algorithm totaled 7906 (3.1%) and were excluded. There were 100,584 ED visits for injuries

(40%), a heterogeneous group ranging from minor to life-threatening conditions that were not categorized by the Billings and colleagues<sup>17</sup> algorithm and were therefore excluded. Visits with missing covariates (n = 253) were excluded. Of the remaining 141,709 visits, 97,961 were classified as low severity (69%), 33,941 as intermediate severity (24%), and 9807 as high severity (7%). The 141,709 severity-classified ED visits occurred among 73,530 unique children (59.4% with a single visit and 20.7% with 2 visits); 95% of our data came from children having 5 or fewer ED visits over a span of 12 years. Our main analysis was restricted to low- and high-severity visits (n = 107,768), which occurred among 61,179 children (63.5% had 1 visit, 20% had 2 visits). The vast majority (95%) of children had 4 or fewer visits.

The most common diagnoses for each severity category are shown in **Table 1**. Low-severity visits were primarily diagnoses related to upper respiratory infections or other cold-like conditions. Abdominal pain was the primary diagnosis among 18% of intermediate-severity claims, followed by a diverse mix of other conditions. High-severity visits had several asthma-related diagnoses—in all, more than 50% of these visits had an asthma-related diagnosis.

**Table 2** displays the characteristics of ED visits stratified by severity. Low-severity visits occurred more frequently in children aged 1 year and younger, 2 to 3 years, and 4 to 5 years; Caucasians; children with small rural and isolated residences; children who visited the ED on Sundays and Saturdays; and children who lived in areas with low utilization of appropriate well-child care. Low-severity visits occurred less often among children aged 12 to 19 years, males, African Americans, urban residents, children receiving management for a chronic disease, and children living in areas of high utilization of well-child care.

**Table 3** presents results from multivariate logistic models that investigated factors associated with low-severity visits. The reported risk differences represent percentage point differences in the fraction of low-severity ED patients who had a given characteristic (vs the referent) relative to high-severity ED patients. For example, the table presents evidence that low-severity ED patients were more likely to be younger than high-severity ED patients. The risk differences indicate that compared with children aged 0 to 1 year, children aged 2 to 3 years were 0.7 percentage points (95% CI, -1.4 to -0.1) less likely to have had a low-severity visit; children aged 4 to 5 years were 1.2 percentage points less likely (95% CI, -1.9 to -0.5); children aged 6 to 11 years were 2.7 percentage points less likely (95% CI, -3.4 to -2.1); and children aged 12 to 19 years were 3.7 percentage points less likely (95% CI, -4.3 to -3.0). Low-severity ED patients were less likely to be male (1.4 percentage points; 95% CI, -1.8 to -1.1); to be African

■ **Table 1.** Frequency Distribution of Emergency Department Diagnoses by Severity<sup>a</sup>

Low Severity (n = 97,961)			Intermediate Severity (n = 33,941)			High Severity (n = 9807)		
Code <sup>b</sup>	Description	%	Code <sup>b</sup>	Description	%	Code <sup>b</sup>	Description	%
462	Acute pharyngitis	9.1	789	Abdominal pain—site NOS	18.2	493.92	Asthma NOS with acute exacerbation	19.5
465.9	Acute upper respiratory infection NOS	8.9	487.1	Flu with respiratory manifestation NEC	6.6	493.90	Asthma without status asthma	15.6
382.9	Otitis media NOS	8.4	780.60	Fever, unspecified	5.5	780.39	Other convulsions	10.3
780.6	Fever	5.8	786.50	Chest pain NOS	5.5	493.02	Extrinsic asthma with acute exacerbation	9.1
558.9	Noninfectious gastroenteritis NEC	5.3	486	Pneumonia, organism NOS	5.0	276.5	Hypovolemia	5.4
079.99	Viral infection NOS	4.7	780.2	Syncope and collapse	4.7	276.51	Dehydration	5.1
599.0	Urinary tract infection NOS	3.8	682.6	Cellulitis of leg	3.9	493.00	Extrinsic asthma with no status asthma	4.9
466.0	Acute bronchitis	3.4	789.09	Abdominal pain—site NEC	3.3	V71.5	Observation-alleged rape	3.2
784.0	Headache	3.3	564.00	Constipation NOS	3.2	780.31	Febrile convulsions	2.9
034.0	Strep sore throat	3.0	464.4	Croup	3.0	592.1	Calculus of ureter	2.5
490	Bronchitis NOS	2.5	789.03	Right-lower-quadrant abdominal pain	2.2	276.50	Volume depletion, unspecified	1.8
787.03	Vomiting alone	2.4	682.3	Cellulitis of arm	1.9	493.01	Acute pyelonephritis NOS	1.5
787.01	Nausea with vomiting	2.0	789.06	Epigastric abdominal pain	1.8	590.10	Extrinsic asthma with status asthma	1.3
786.52	Painful respiration	1.6	786.59	Chest pain NEC	1.8	540.9	Acute appendicitis NOS	1.3
463	Acute tonsillitis	1.4	786.09	Respiratory abnormality NEC	1.6	592.0	Calculus of kidney	1.3
380.10	Infectious otitis externa NOS	1.4	733.6	Tietze's disease	1.5	788.0	Renal colic	1.0
473.9	Chronic sinusitis NOS	1.3	708.0	Allergic urticaria	1.5	785.0	Tachycardia NOS	0.9
461.9	Acute sinusitis NOS	1.3	535.50	Gastritis/duodenitis NOS	1.4	578.9	Gastrointestinal hemorrhage NOS	0.9
782.1	Nonspecific skin eruptions NEC	1.2	682.2	Cellulitis of trunk	1.4	493.91	Asthma with status asthma	0.8
786.2	Cough	1.2	682.5	Cellulitis of buttock	1.2	578.0	Hematemesis	0.7
	All other diagnoses	28.0		All other diagnoses	24.5		All other diagnoses	10.0

NEC indicates not elsewhere classified; NOS, not otherwise specified.

<sup>a</sup>As determined by the algorithm developed by Billings and colleagues,<sup>17</sup> with severity described by Wharam and colleagues.<sup>18</sup>

<sup>b</sup>International Classification of Disease, Ninth Revision, Clinical Modification diagnosis codes.

American (−1.5 percentage points; 95% CI, −1.9 to −1.1); to have a previously diagnosed chronic disease (10.3 percentage points; 95% CI, −10.7 to −9.9); and to live in an area with high compliance with appropriate well-child care (1.2 percentage points; 95% CI, −0.4 to −1.9). In contrast, low-severity ED patients were more likely to be from isolated areas

(1.6 percentage points; 95% CI, 1.0-2.2), and have visits on Sunday (0.9 percentage point; 95% CI, 0.6-1.3) and Saturday (1.2 percentage points; 95% CI, 0.1-1.6). Although not presented here, results from the logistic regression model comparing intermediate- versus high-severity visits are included in the [Appendix](#).

## Characteristics of Low-Severity ED Use

**■ Table 2.** Characteristics of Emergency Department Care Comparing Low-Severity With High-Severity Visits and Intermediate-Severity With High-Severity Visits<sup>a</sup>

Characteristics	Low Severity (n = 97,961)		Intermediate Severity (n = 33,941)		High Severity (n = 9807)	
	No.	%	No.	%	No.	%
<b>Age, y</b>						
2-3	9751	10.0 <sup>b</sup>	2160	6.4 <sup>c</sup>	717	7.3
4-5	7520	7.7 <sup>b</sup>	1762	5.2 <sup>b</sup>	605	6.2
6-11	31,921	32.6 <sup>b</sup>	9876	29.1 <sup>b</sup>	3359	34.2
12-19	40,658	41.5 <sup>b</sup>	18,368	54.1 <sup>b</sup>	4605	47.0
<b>Male</b>	44,683	45.6 <sup>b</sup>	14,688	43.3 <sup>b</sup>	5017	51.2
<b>Race</b>						
Caucasian	58,386	59.6 <sup>b</sup>	20,290	59.8 <sup>b</sup>	5328	54.4
African American	32,410	33.1 <sup>b</sup>	11,222	33.1 <sup>b</sup>	3893	39.7
Other/unknown	7165	7.3 <sup>b</sup>	2429	7.2 <sup>b</sup>	576	5.9
<b>Federal poverty level</b>						
01%-150%	61,061	62.3 <sup>d</sup>	21,672	63.9	6233	63.5
151%-200%	35,390	36.1 <sup>d</sup>	11,541	34.0	3417	34.8
201%-300%	796	0.8 <sup>c</sup>	429	1.3	109	1.1
Exempt	714	0.7 <sup>c</sup>	299	0.9 <sup>b</sup>	48	0.5
<b>RUCA category</b>						
Urban	57,281	58.5 <sup>b</sup>	20,016	62.0 <sup>b</sup>	6268	63.9
Large rural area	13,416	13.7	4461	13.1	1306	13.3
Small rural area	14,723	15.0 <sup>b</sup>	4765	14.0 <sup>c</sup>	1247	12.7
Isolated	11,509	11.8 <sup>b</sup>	3406	10.0 <sup>c</sup>	884	9.0
Unknown	1032	1.0	293	0.9	102	1.1
<b>Chronic disease present</b>	29,151	29.8 <sup>b</sup>	11,330	33.4 <sup>b</sup>	6413	65.4
<b>Day of week</b>						
Sunday	19,450	19.9 <sup>b</sup>	5930	17.5	1768	18.1
Saturday	16,697	17.0 <sup>b</sup>	4919	14.5	1424	14.5
Other	61,814	63.1 <sup>b</sup>	23,092	68.0	6615	67.4
<b>Quarter</b>						
January-March	28,317	28.9 <sup>b</sup>	8543	25.2	2500	25.5
April-June	21,847	22.3	7338	21.6	2197	22.4
July-September	22,117	22.6 <sup>c</sup>	9197	27.1 <sup>b</sup>	2335	23.8
October-December	25,680	26.2 <sup>b</sup>	8863	26.1 <sup>b</sup>	2775	28.3
<b>First enrollment in ALL Kids</b>	41,677	42.5 <sup>b</sup>	12,490	36.8	3641	37.1
<b>Appropriate well-child care<sup>e</sup></b>						
Very low	26,125	26.7 <sup>b</sup>	7140	21.0	2079	21.2
Low	24,777	25.3	8300	24.5	2419	24.7
Intermediate	23,966	24.4 <sup>d</sup>	8979	26.5	2507	25.5
High	23,093	23.6 <sup>b</sup>	9522	28.0	2802	28.6

RUCA indicates Rural Urban Commuting Area.

<sup>a</sup>P value for  $\chi^2$  test of low severity versus high severity (excluding intermediate) and intermediate severity versus high severity (excluding low).

<sup>b</sup>P < .001.

<sup>c</sup>P < .01.

<sup>d</sup>P < .05.

<sup>e</sup>Based on quartiles of children within zip code meeting well-child visit criteria.

■ **Table 3.** Adjusted Relationship Between Low-Severity Emergency Department Visits and High-Severity Visits<sup>a</sup>

Characteristics	Risk Differences (95% CI)	Odds Ratio (95% CI)
<b>Age, y</b>		
0-1		Reference
2-3	-0.7 (-0.1 to -1.4) <sup>b</sup>	0.8 (0.7-0.9)
4-5	-1.2 (-0.5 to -1.9) <sup>c</sup>	0.8 (0.7-0.9)
6-11	-2.7 (-2.1 to -3.3) <sup>d</sup>	0.6 (0.5-0.7)
12-19	-3.7 (-3.0 to -4.3) <sup>d</sup>	0.5 (0.5-0.6)
<b>Male</b>	-1.4 (-1.1 to -1.8) <sup>d</sup>	0.8 (0.7-0.9)
<b>Race</b>		
Caucasian		Reference
African American	-1.5 (-1.1 to -1.9) <sup>d</sup>	0.8 (0.7-0.9)
Other/unknown	0.2 (-0.5 to 0.9)	1.0 (0.9-1.2)
<b>Federal poverty level</b>		
101%-150%		Reference
151%-200%	-0.4 (-0.1 to -0.8) <sup>b</sup>	0.9 (0.9-1.0)
201%-300%	-2.2 (-0.2 to -4.3) <sup>b</sup>	0.7 (0.6-0.9)
Exempt	1.6 (-0.1 to 3.3)	1.3 (0.9-1.8)
<b>RUCA category</b>		
Urban		Reference
Large rural area	0.3 (-0.4 to 0.9)	1.0 (0.9-1.1)
Small rural area	1.1 (0.5 - 1.7) <sup>d</sup>	1.2 (1.1-1.3)
Isolated	1.6 (1.0 - 2.2) <sup>d</sup>	1.3 (1.2-1.4)
Unknown	<0.01 (-1.5 to 1.6)	1.0 (0.8-1.2)
<b>Chronic disease present</b>	-10.3 (-9.9 to -10.7) <sup>d</sup>	0.2 (0.2-0.2)
<b>Day of week</b>		
Other		Reference
Sunday	0.9 (0.6, 1.3) <sup>d</sup>	1.1 (1.1-1.2)
Saturday	1.2 (0.8, 1.6) <sup>d</sup>	1.2 (1.1-1.3)
<b>Appropriate well-child care<sup>e</sup></b>		
Very low		Reference
Low	-0.4 (-1.0 to 0.2)	0.9 (0.8-1.0)
Intermediate	-0.4 (-1.1 to 0.3)	0.9 (0.8-1.0)
High	-1.2 (-0.4 to -1.9) <sup>d</sup>	0.8 (0.7-0.9)

CI indicates confidence interval; RUCA, Rural Urban Commuting Area.

<sup>a</sup>Model also adjusted for month (by quarters), calendar year of visit, and previous enrollment in ALL Kids. Multiple visits per child were controlled for using robust clustered standard errors.

<sup>b</sup>*P* < .05.

<sup>c</sup>*P* < .01.

<sup>d</sup>*P* < .001.

<sup>e</sup>Based on quartiles of children within zip code meeting well-child visit criteria.

## DISCUSSION

Using a pooled cross-sectional study of ED claims, we identified characteristics of low-severity ED patients in the Alabama CHIP, ALL Kids. Overall, we found that the majority of non-injury related ED visits were for low-severity conditions. Even though we cannot determine how many of these visits

were unavoidable, some of the patterns we identified suggest that barriers to accessing other less resource-intensive sources of healthcare may contribute to use of the ED for low-severity visits. For example, we observed more use of the ED for low-severity visits relative to high-severity visits on weekends and for rural patients; both findings may represent decreased access to primary care. In addition, children living in zip codes with

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the highest proportions of appropriate well-child visit rates (a proxy measure of access to primary care) had a lower likelihood of visiting the ED for a low-severity relative to a high-severity condition in the 12 years of data that we examined.

Access to primary care is known to reduce low-severity ED utilization. Previous research has found that shortcomings in access to primary care<sup>8,25</sup> or deficiencies in the quality of primary care<sup>6,8,9</sup> contribute to low-severity ED use. Moreover, Halfon and colleagues<sup>12</sup> previously found that primary care physician supply within a county influenced appropriate ED use behavior. The results of the current study, which focused on low-income children, are consistent with this body of literature.

In our study, children with chronic diseases who utilized the ED were less likely to do so for low-severity visits than children without a chronic disease. This might be either because children with chronic diseases utilized the ED for reasons related to the underlying condition and as a result the visits were classified as more severe in nature, or because the increased contact with the healthcare system stemming from their chronic disease made them better consumers of appropriate resources. Children with chronic illnesses are known to use the ED with greater frequency than other children,<sup>26</sup> but studies have not evaluated the severity of those visits. The primary chronic disease observed among children in ALL Kids was asthma. Although asthmatic episodes can be prevented through improved disease management,<sup>27</sup> children experiencing symptoms need ED care and this is considered a high-severity visit by the Billings and colleagues<sup>17</sup> algorithm and Wharam and colleagues method.<sup>18</sup>

Nonmodifiable characteristics such as sex and race were associated with differential patterns of ED use. Although some prior studies have suggested that African Americans are more likely to use the ED for low-severity care,<sup>12,28</sup> others have not.<sup>14</sup> In the current study, African American children who utilized the ED were less likely to do so for a low-severity ED visits compared with children of other races. We also found that female patients had a larger fraction of low-severity ED visits, which is consistent with previous work that identified females as using the ED for routine care more frequently.<sup>14</sup> Lastly, we observed younger age groups were associated with a larger share of low-severity ED visits than high-severity ED visits. Infants younger than 12 months of age have the highest annual ED visit rate nationally,<sup>1</sup> potentially due to the tendency of parents to err on the side of caution with newborns.

The findings of this study should be interpreted in light of some limitations. First, claims data have inherent limitations for research or clinical purposes given that they are collected for administrative reasons.<sup>29</sup> Second, ED claims in our study were categorized based on primary diagnosis only, and the algorithm for classifying visit severity based on diagnosis codes

may have failed to capture all aspects of a child's ED visit. Despite this, the methodologies of Billings and colleagues<sup>17</sup> and Wharam and colleagues<sup>18</sup> are reproducible and have been validated. If physicians make arbitrary decisions as to which diagnosis is listed first or second, then misclassification of severity could have occurred. Third, the algorithms to classify ED visits may have limitations when applied exclusively to children, given that they were developed in a multiuse ED. Lastly, the results of this study should be generalized with caution to populations outside Alabama or CHIPs in general, especially when administered differently from ALL Kids.

Several factors are associated with the use of the ED for low-severity conditions among Alabama children enrolled in CHIP. However, some modifiable factors are reflective of limited utilization of, and possibly access to, quality primary care. Low-severity ED utilization may be reduced when primary care providers offer evening and weekend hours.<sup>6,8</sup> Moreover, retail health clinics and urgent care centers, which utilize fewer resources than EDs, offer the potential to more efficiently treat low-severity conditions during off-hours.<sup>4</sup> Policy makers may be able to reduce low-severity ED visits by encouraging expanded access to times and locations that primary care services are provided.

**Author Affiliations:** From Department of Health Care Organization and Policy (JB, DJB, MAM, NM), University of Alabama at Birmingham, Birmingham, AL; Alabama Department of Public Health (CC), Bureau of Children's Health Insurance, Montgomery, AL.

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**Address correspondence to:** Justin Blackburn, PhD, 1665 University Blvd, Rm 330, Birmingham, AL 35294. E-mail: jblackburn@uab.edu.

## REFERENCES

1. Niska R, Bhuiya F, Xu J. National Hospital Ambulatory Medical Care Survey: 2007 emergency department summary. *Natl Health Stat Report*. 2010;(26):1-31.
2. Gordon JA, Billings J, Asplin BR, Rhodes KV. Safety net research in emergency medicine: proceedings of the Academic Emergency Medicine Consensus Conference on "The Unraveling Safety Net." *Acad Emerg Med*. 2001;8(11):1024-1029.
3. Johnson WG, Rimsza ME. The effects of access to pediatric care and insurance coverage on emergency department utilization. *Pediatrics*. 2004;113(3, pt 1):483-487.
4. Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Aff (Millwood)*. 2010;29(9):1630-1636.

5. Grumbach K, Keane D, Bindman A. Primary care and public emergency department overcrowding. *Am J Public Health.* 1993;83(3):372-378.
6. Lowe RA, Localio AR, Schwarz DF, et al. Association between primary care practice characteristics and emergency department use in a Medicaid managed care organization. *Med Care.* 2005;43(8):792-800.
7. Billings J, Parikh N, Mijanovich T. Emergency department use in New York City: a substitute for primary care? *Issue Brief (Commonw Fund).* 2000;433:1-5.
8. Berry A, Brousseau D, Brotanek JM, Tomany-Korman S, Flores G. Why do parents bring children to the emergency department for non-urgent conditions? a qualitative study. *Ambul Pediatr.* 2008;8(6):360-367.
9. Stanley R, Zimmerman J, Hashikawa C, Clark SJ. Appropriateness of children's nonurgent visits to selected Michigan emergency departments. *Pediatr Emerg Care.* 2007;23(8):532-536.
10. Christakis DA, Mell L, Koepsell TD, Zimmerman FJ, Connell FA. Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. *Pediatrics.* 2001;107(3):524-529.
11. Brousseau DC, Gorelick MH, Hofmann RG, Flores G, Nattinger AB. Primary care quality and subsequent emergency department utilization for children in Wisconsin Medicaid. *Acad Pediatr.* 2009;9(1):33-39.
12. Halfon N, Newacheck PW, Wood DL, St Peter RF. Routine emergency department use for sick care by children in the United States. *Pediatrics.* 1996;98(1):28-34.
13. Wilson KM, Klein JD. Adolescents who use the emergency department as their usual source of care. *Arch Pediatr Adolesc Med.* 2000;154(4):361-365.
14. Hong R, Baumann BM, Boudreaux ED. The emergency department for routine healthcare: race/ethnicity, socioeconomic status, and perceptual factors. *J Emerg Med.* 2007;32(2):149-158.
15. Phelps K, Taylor C, Kimmel S, Nagel R, Klein W, Puczynski S. Factors associated with emergency department utilization for nonurgent pediatric problems. *Arch Fam Med.* 2000;9(10):1086-1092.
16. Department of Health and Human Services. Children's Health Insurance Program Reauthorization Act 2011 Annual Report on the Quality of Care for Children in Medicaid and CHIP. [http://www.medicare.gov/Medicaid-CHIP-Program-Information/By-Topics/Quality-of-Care/Downloads/2011\\_StateReporttoCongress.pdf](http://www.medicare.gov/Medicaid-CHIP-Program-Information/By-Topics/Quality-of-Care/Downloads/2011_StateReporttoCongress.pdf). Published September 2011. Accessed April 27, 2012.
17. Billings J, Parikh N, Mijanovich T. Emergency department use: the New York story. *Issue Brief (Commonw Fund).* 2000;434:1-12.
18. Wharam JF, Landon BE, Galbraith AA, Kleinman KP, Soumerai SB, Ross-Degnan D. Emergency department use and subsequent hospitalization among members of a high-deductible health plan. *JAMA.* 2007;297(10):1093-1102.
19. WWAMI Rural Health Research Center. RUCA Data. 2004. <http://depts.washington.edu/uwruca/ruca-data.php>. Published July 2005. Accessed October 2012.
20. Becker DJ, Blackburn JL, Kilgore ML, et al. Continuity of insurance coverage and ambulatory care-sensitive hospitalizations/ED visits: evidence from the children's health insurance program. *Clin Pediatr (Phila).* 2011;50(10):963-973.
21. National Committee for Quality Assurance. HEDIS® 2011: Technical Specifications. Washington, DC: NCOA; 2010.
22. Holcomb WL Jr, Chaiworapongsa T, Luke DA, Burgdorf KD. An odd measure of risk: use and misuse of the odds ratio. *Obstet Gynecol.* 2001;98(4):685-688.
23. Tajeu GS, Sen B, Allison DB, Menachemi N. Misuse of odds ratios in obesity literature: an empirical analysis of published studies. *Obesity (Silver Spring).* 2012;20(8):1726-1731.
24. Williams RL. A note on robust variance estimation for cluster-correlated data. *Biometrics.* 2000;56(2):645-646.
25. Kini NM, Strait RT. Nonurgent use of the pediatric emergency department during the day. *Pediatr Emerg Care.* 1998;14(1):19-21.
26. Fosarelli PD, DeAngelis C, Mellits ED. Health services use by children enrolled in a hospital-based primary care clinic: a longitudinal perspective. *Pediatrics.* 1987;79(2):196-202.
27. Lieu TA, Quesenberry CP Jr, Capra AM, Sorel ME, Martin KE, Mendoza GR. Outpatient management practices associated with reduced risk of pediatric asthma hospitalization and emergency department visits. *Pediatrics.* 1997;100(3, pt 1):334-341.
28. Oster A, Bindman AB. Emergency department visits for ambulatory care sensitive conditions: insights into preventable hospitalizations. *Med Care.* 2003;41(2):198-207.
29. Bright RA, Avorn J, Everitt DE. Medicaid data as a resource for epidemiologic studies: strengths and limitations. *J Clin Epidemiol.* 1989;42(10):937-945. ■

## Characteristics of Low-Severity ED Use

### ■ **Appendix.** Adjusted Relationship Between Intermediate-Severity Emergency Department Visits and High-Severity Visits<sup>a</sup>

Characteristics	Risk Differences (95% CI)	Odds Ratio (95% CI)
<b>Age, y</b>		
0-1		Reference
2-3	-2.1 (-0.5 to 0.1)	0.9 (0.8-1.0)
4-5	-1.5 (-4.2 to 1.1)	0.9 (0.8-1.1)
6-11	-1.1 (-3.4 to 1.2)	0.9 (0.9-1.1)
12-19	1.9 (-0.4 to 4.2)	1.1 (0.9-1.3)
<b>Male</b>	-3.5 (-2.5 to -4.4) <sup>b</sup>	0.8 (0.7-0.9)
<b>Race</b>		
Caucasian		Reference
African American	-3.9 (-2.5 to -4.5) <sup>b</sup>	0.8 (0.7-0.8)
Other/unknown	0.7 (-1.1 to 2.5)	1.0 (0.9-1.2)
<b>Federal poverty level</b>		
101%-150%		Reference
151%-200%	-0.2 (-1.1 to 0.8)	1.0 (0.9-1.0)
201%-300%	-1.5 (-5.7 to 2.6)	0.9 (0.7-1.2)
Exempt	5.3 (0.8-9.7) <sup>c</sup>	1.4 (1.1-2.1)
<b>RUCA category</b>		
Urban		Reference
Large rural area	-1.4 (-3.2 to 0.3)	0.9 (0.8-1.0)
Small rural area	0.7 (-0.9 to 2.1)	1.0 (0.9-1.1)
Isolated	0.4 (-1.3 to 2.2)	1.0 (0.9-1.1)
Unknown	-2.2 (-6.7 to 2.3)	0.9 (0.7-1.1)
<b>Chronic disease present</b>	-21.3 (-20.7 to -22.7) <sup>b</sup>	0.3 (0.2-0.3)
<b>Day of week</b>		
Other		Reference
Sunday	-0.2 (-1.2 to 0.8)	1.0 (0.9-1.1)
Saturday	0.1 (-1.0 to 1.2)	1.0 (0.9-1.1)
<b>Appropriate well-child care</b>		
Very low		Reference
Low	-0.5 (-2.0 to 1.0)	0.9 (0.9-1.1)
Intermediate	-1.1 (-2.8 to 0.7)	0.9 (0.8-1.0)
High	-2.2 (-0.3 to -4.0) <sup>c</sup>	0.9 (0.8-0.9)

CI indicates confidence interval; RUCA, Rural Urban Commuting Area. Model also adjusted for month (by quarters), calendar year of visit, and previous enrollment in ALL Kids. Multiple visits per child were controlled for using robust clustered standard errors.

<sup>b</sup>P < .001.

<sup>c</sup>P < .05.

<sup>d</sup>Based on quartiles of children within zip code meeting well-child visit criteria.