Characteristics of Children Enrolled in Medicaid With High-Frequency Emergency Department Use

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abstract

BACKGROUND AND OBJECTIVES: Some children repeatedly use the emergency department (ED) at high levels. Among Medicaid-insured children with high-frequency ED use in 1 year, we sought to describe the characteristics of children who sustain high-frequency ED use over the following 2 years.

METHODS: Retrospective longitudinal cohort study of 470 449 Medicaid-insured children appearing in the MarketScan Medicaid database, aged 1–16 years, with ≥1 ED discharges in 2012. Children with high ED use in 2012 (≥4 ED discharges) were followed through 2014 to identify characteristics associated with sustained high ED use (≥8 ED discharges in 2013–2014 combined). A generalized linear model was used to identify patient characteristics associated with sustained high ED use.

RESULTS: A total of 39 945 children (8.5%) experienced high ED use in 2012, accounting for 25% of total ED visits in 2012. Sixteen percent of these children experienced sustained high ED use in the following 2 years. Adolescents (adjusted odds ratio [aOR]: 1.4 [95% confidence interval: 1.3–1.5]), disabled children (aOR: 1.3 [95% confidence interval: 1.1–1.5]), and children with 3 or more chronic conditions (aOR: 2.1, [95% confidence interval: 1.9–2.3]) experienced the highest likelihood for sustaining high ED use.

CONCLUSIONS: One in 6 Medicaid-insured children with high ED use in a single year experienced sustained high levels of ED use over the next 2 years. Adolescents and individuals with multiple chronic conditions were most likely to have sustained high rates of ED use. Targeted interventions may be indicated to help reduce ED use among children at high risk.

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WHAT'S KNOWN ON THIS SUBJECT: Many initiatives have been developed to improve care for Medicaid-insured children with high-level emergency department (ED) use. Little is known about trends in pediatric ED use or the characteristics of children who experience high numbers of ED visits over time.

WHAT THIS STUDY ADDS: Sixteen percent of Medicaid-insured children with high-frequency ED use in 1 year sustain high levels of ED use over the following 2 years. Adolescents and individuals with multiple chronic conditions have the highest likelihood of sustaining high ED use.

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Children who repeatedly visit the emergency department (ED) account for a substantial share of overall ED resource use.[1–5] In previous studies, researchers have demonstrated that children with 4 or more ED visits in a single year account for between 13% and 42% of all ED use at pediatric EDs.[1,2,4] Medicaid-insured children often visit the ED at higher rates than privately insured children.[1,6–9] The reasons cited for higher ED use among Medicaid enrollees include higher burdens of certain chronic conditions and worse access to timely primary[10] and preventative care. In response, clinicians and state health officials have often partnered to promote initiatives aimed at controlling or reducing the high ED use experienced by some Medicaid-insured children.[11–13] Examples of previous interventions to reduce potentially unnecessary ED use include providing more enhanced primary care via the patient-centered medical home, delivering comprehensive care management services after ED discharge, and offering health education programs to caregivers. In some of these interventions, researchers have reported notable reductions in ED use after their implementation.[13–17]

However, it is often unclear if these trends result from the intervention designed to reduce ED use, from resolving disease status, or from normal variations in health care service use. Data from adults suggest that most high users of the ED will experience considerably lower service use over time.[18] The literature on the persistence of ED use among children who use the ED at high levels is sparse. Previous studies have been limited to evaluations of children receiving care within a single geographic region,[4] at children's hospitals or pediatric EDs,[1,2,19] or infants[20] and children with specific chronic condition (ie, sickle cell disease).[21] These studies did not examine longitudinal trends in ED use across multiple EDs in a continuous, geographically diverse cohort of Medicaid-insured children. In addition, although the vast majority of pediatric ED visits[22] result in discharge from the ED after evaluation and treatment, to our knowledge, there are no previous studies in which researchers have examined the characteristics of Medicaid-insured children who experience persistently high numbers of these lower-acuity ED visits. A better understanding of which children may be at risk for frequent ED discharges has import because many of these visits might be safely delivered in less resource-intensive outpatient settings, such as urgent care, or prevented through more effective use of the patient-centered medical home.[13,23] Thus, a better understanding of how often children experience sustained high numbers of ED discharges and which children are at highest likelihood will enable clinicians and policy makers to focus efforts on children who will benefit the most from interventions.[24]

Accordingly, our objectives with this study were the following: (1) to identify Medicaid-insured children who experience high numbers of ED visits during an index year, (2) to describe the trends in their ED use over the subsequent 2 years, and (3) to identify the demographic and clinical characteristics of children who experience sustained high levels of ED use across all 3 study years.

METHODS

Study Design

We conducted a retrospective cohort study of children aged 1 to 16 years, who were continuously enrolled in their state's Medicaid or Children's Health Insurance Program (from here on referred to as Medicaid) from 2011 to 2014. We defined continuous enrollment as 11 or more months of enrollment in Medicaid in each calendar year of the study period. Children <1 year of age were permitted <11 months of enrollment in their first year of life. We excluded children >17 years (as of December 31, 2012) to ensure complete follow-up of children through their 19th birthday, which is when the eligibility levels for Medicaid typically change.

Data Source

We used the Truven MarketScan Medicaid database (Truven Health Analytics, Ann Arbor, MI), a proprietary data set containing longitudinal patient-level demographic, Medicaid enrollment, and health care claim data. MarketScan permits measurement of unique individuals across multiple years within the same state (but not across states) and permits tracking of individuals through periods of disenrollment and reenrollment ("churn"). Data from both fee-for-service and managed care Medicaid programs are included in the database. Children represented in our sample resided in 1 of 10 geographically dispersed and deidentified states.

Measuring ED Visits

We studied ED visits that resulted in discharge and did not result in hospital admission or death (from here on referred to as "ED visits"). We identified children who experienced 1 or more ED visit(s) during the index period from January 1, 2012, through December 31, 2012. The cohort was dichotomized based on the number of ED visits in 2012. Children with high ED use were defined as having 4 or more ED visits in 2012 (a threshold we selected on the basis of use in multiple previous studies).[1,2,4] We then measured the number of ED visits each child experienced in 2013 and 2014. We characterized the reasons for each ED visit using the diagnosis grouping system, a classification system developed specifically for

categorizing the reasons for pediatric ED visits on the basis of *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) billing codes.[25]

Main Outcome Measures

The main outcome measure was sustained high ED use, defined as 8 or more ED visits in 2013 and 2014 combined. This threshold represents the sum of the top decile of ED visits experienced by the cohort in 2013 (4 ED visits) and 2014 (4 ED visits).

Demographic and Clinical Characteristics

We included patient demographics, clinical characteristics, and insurance types (fee-for service versus managed care) which may correlate with high ED use. The demographic characteristics included patient age (<2, 2–5, 6–11, and 12–16 years),[26] sex, race and/or ethnicity (white, African American, Hispanic, and other), and whether the child became eligible for Medicaid as the result of a disability. Age was calculated as of December 31, 2012. Because only birth year (not birth day or month) was available in the database, we counted children born anytime in 2011 in the <2 years old category.

We categorized the number, type, and severity of each child's chronic conditions using 2 widely used classification schemas based on ICD-9-CM codes abstracted from Medicaid claims.[27,28] ICD-9-CM codes were abstracted from paid claims for any service (eg, outpatient, inpatient, ED, etc) received in the 12 months preceding the index ED visit in 2012. To evaluate whether children with an increasing number of chronic conditions were more likely to experience sustained high ED use, we used the Agency for Healthcare Research and Quality's Chronic Condition Indicator[27] to count the number of chronic conditions endured by each child (0, 1, 2, and ≥3). To evaluate whether children with severe chronic conditions were more likely to experience sustained high ED use, we used the complex chronic conditions (CCCs) indicator to identify children with conditions known to be associated with a significant risk of morbidity or death (for example, cerebral palsy and spina bifida).[28]

Statistical Analysis

We determined rates of ED use in 2013 to 2014 for children with and without high ED use in 2012. We also separately reported the number of ED visits experienced by children with continuous insurance coverage during the study period but no ED visits in 2012; however, these children were not included in any of the subsequent analyses. We used χ^2 tests to assess the association between each of the covariates and the main outcome variable (sustained high ED use in 2013–2014). We compared the paired difference in ED visits in 2012 and annualized visits in 2013 and 2014 using a Wilcoxon rank test. To model the associations between the demographic and clinical characteristics and the binary outcome variable (sustained high ED use in 2013–2014), we developed a generalized linear model. We conducted 2 sensitivity analyses. First, to evaluate associations with consistent levels of use in each of the study years, we modeled a more conservative definition of sustained high ED use (≥4 ED visits in both 2013 and 2014). Second, to evaluate whether less restrictive insurance enrollment would change the results, among individuals with high ED use, we modified the eligibility threshold to ≥9 months of Medicaid enrollment per year. SAS 9.4 (SAS Institute, Cary, NC) was used for all analyses, and statistical significance was set at $P < .05$. The institutional review board at Boston Children's Hospital determined this study to be exempt from review.

RESULTS

Study Population

The study cohort consisted of 470 449 children who experienced at least 1 ED visit during the index period from January 1, 2012, through December 31, 2012. These children experienced a total of 832 252 ED visits. Two-thirds of these children had a chronic condition and nearly 40% had multiple chronic conditions (according to the Chronic Condition Indicator schema). Nine percent of children had a CCC (using the CCC schema). The majority (85%) of children were enrolled in a managed care health plan, and ∼6% qualified for Medicaid as a result of a disability (Table 1).

High ED Users in 2012

Overall, 8.5% (n = 39 945) of the study cohort experienced high ED use in 2012 (4 or more ED visits), accounting for one-quarter of all ED visits in 2012. Compared with nonhigh ED users in 2012, high ED users in 2012 had a higher prevalence of chronic conditions (75.5% vs 64.7%), multiple chronic conditions (51.1% vs 37.9%) and CCCs (16.5% vs 8.5%). The most common diagnosis grouping system classifications for visits by high ED users were fever (19.4%), respiratory disease (17.3%), and upper respiratory infections (17.1%) (Table 2).

Trends in ED Use in 2013 and 2014 for High ED Users

Children with high ED use in 2012 experienced fewer annual ED visits over the next 2 years. These children incurred a median of 5 ED visits in 2012 (interquartile range: 4–6) compared with 1.5 ED visits per year (interquartile range: 1–3) in 2013 and 2014.

Children With Sustained High ED Use

Nearly 16% (15.7%) of high ED users in 2012 sustained their high ED use over the next 2 years. By comparison,

TABLE 1 Demographic and Clinical Characteristics of the Medicaid-Insured Children With at Least 1 ED Visit in 2012

Characteristics, *n* (%)	All ED Users	ED Use in 2012[a]	
	N = 470 449	1–3 Visits	≥4 Visits
		n = 430 504 (92%)	*n* = 39 945 (8%)
Age group, y			
<2	57 960 (12.3)	47 970 (11.1)	9990 (25.0)
2–5	159 916 (34.0)	145 251 (33.7)	14 665 (36.7)
6–11	151 228 (32.1)	142 956 (33.2)	8272 (20.7)
12–16	101 345 (21.5)	94 327 (21.9)	7018 (17.6)
Male sex	248 427 (52.8)	227 532 (52.9)	20 895 (52.3)
Race and/or ethnicity			
White	214 323 (45.6)	195 582 (45.4)	18 741 (46.9)
African American	173 782 (36.9)	159 482 (37.0)	14 300 (35.8)
Hispanic	32 867 (7.0)	30 701 (7.1)	2166 (5.4)
Other	49 477 (10.5)	44 739 (10.4)	4738 (11.9)
Insurance type			
Fee-for-service	67 287 (14.3)	60 809 (14.1)	6478 (16.2)
Managed care	403 162 (85.7)	369 695 (85.9)	33 467 (83.8)
Basis of eligibility: disability	27 010 (5.7)	23 714 (5.5)	3296 (8.3)
No. of chronic conditions			
None	161 780 (34.4)	152 008 (35.3)	9772 (24.5)
1	125 201 (26.6)	115 459 (26.8)	9742 (24.4)
2	77 893 (16.6)	70 654 (16.4)	7239 (18.1)
≥3	105 575 (22.4)	92 383 (21.5)	13 192 (33.0)
CCCs			
Any	43 412 (9.2)	36 802 (8.5)	6610 (16.5)
Cardiology	9064 (1.9)	7535 (1.8)	1529 (3.8)
Congenital or genetic	8771 (1.9)	7521 (1.7)	1250 (3.1)
Gastrointestinal	3750 (0.8)	2919 (0.7)	831 (2.1)
Hematology and immunology	4639 (1.0)	3880 (0.9)	759 (1.9)
Malignancy	3303 (0.7)	2908 (0.7)	395 (1.0)
Metabolic	10 531 (2.2)	8618 (2.0)	1913 (4.8)
Neonatal	2011 (0.4)	1503 (0.3)	508 (1.3)
Neurology	10 364 (2.2)	8871 (2.1)	1493 (3.7)
Renal	2347 (0.5)	1939 (0.5)	408 (1.0)
Respiratory	2594 (0.6)	2053 (0.5)	541 (1.4)
Technology dependence	4553 (1.0)	3597 (0.8)	956 (2.4)
Transplantation	374 (0.1)	324 (0.1)	50 (0.1)

[a] All comparisons of the "1–3 visits" and "≥4 visits" groups were significant at $P < .001$ using bivariate statistics.

4.3% of children with nonhigh ED use in 2012 (1–3 visits) and 0.2% of children with no ED use in 2012 experienced 8 or more visits over the following 2 years. The most common reasons for visiting the ED for children with sustained high ED use were respiratory diseases (16.0%), upper respiratory tract infections (14.7%), and asthma (13.8%) (Table 2).

TABLE 2 Five Most Common Reasons for ED Visits Among Children With Sustained High Numbers of ED Visits

High ED Use in 2012		Sustained High ED Use in 2013–2014	
Disease Grouping	*n* (% of Total)	Disease Grouping	*n* (% of Total)
1. Fever	39 660 (19.4)	1. Respiratory diseases	11 418 (16.0)
2. Respiratory diseases	35 334 (17.3)	2. Sinus or upper respiratory tract infection	10 494 (14.7)
3. Sinus or upper respiratory tract infection	34 987 (17.1)	3. Asthma	9865 (13.8)
4. Ear infections	25 868 (12.6)	4. Fever	9371 (13.1)
5. Asthma	18 208 (8.9)	5. Abdominal pain	6712 (9.4)
Total, top 5	154 057 (75.3)	Total, top 5	47 860 (67.0)

Children with high ED use in 2012 experienced at least 4 ED discharges in 2012. Children with sustained high ED use in 2013 and 2014 experienced at least 8 ED discharges in 2013 and 2014 combined.

In a multivariable analysis of children with high ED use in 2012, those with sustained high ED use were more often older (age 12–16), white, and female compared with children without sustained high ED use (Table 3). Children with chronic conditions had increased odds of sustaining high ED use (adjusted odds ratio [aOR]: 1.3, 1.6, and 2.1 for children with a single chronic condition, 2 chronic conditions, and 3 or more chronic conditions, respectively) relative to children with no chronic conditions. Disabled children (aOR: 1.3) were also more likely to experience sustained high ED use. Among children with sustained high ED use, 76% had at least 1 chronic condition, 51% had more than 1 chronic condition, 26% were between the ages of 12 to 16 years, and 13% were eligible for Medicaid insurance because of disability. Sensitivity analyses showed no material differences in the odds of sustained high ED use when the threshold used to define sustained high ED use required 4 or more visits in both 2013 and 2014 (Supplemental Table 4) or when the eligibility threshold was adjusted to 9 or more months per year (Supplemental Table 5).

DISCUSSION

Nine percent of Medicaid-insured children visited the ED 4 or more times in 1 year and accounted for ~25% of all ED visits. These children continued using the ED at higher rates in future years than other Medicaid-insured children. However, fewer than 1 in 6 children with high ED use in the original year maintained high levels of ED use over the following 2-year period. Among children with high ED use in 1 year, adolescents and individuals with multiple chronic conditions had the highest likelihood of sustaining high levels of ED use in future years.

To our knowledge, this is the first study in which a continuous,

TABLE 3 Multivariable Analysis of Experiencing Sustained High Numbers of ED Visits in 2013–2014

Characteristics	Sustained High ED Use (≥8 ED Visits in 2013–2014)	
	aOR	95% CI
Age group, y		
<2	Ref	—
2–5	0.81	(0.75–0.87)
6–11	0.87	(0.80–0.95)
12–16	1.38	(1.27–1.50)
Male sex[a]	0.82	(0.77–0.86)
Race and/or ethnicity		
White	Ref	—
African American	0.90	(0.84–0.96)
Hispanic	0.74	(0.65–0.86)
Other	0.94	(0.85–1.04)
Insurance type		
Fee-for-service	Ref	—
Managed care	1.0	(0.92–1.08)
Basis of eligibility: disability[b]	1.28	(1.13–1.45)
No. of chronic conditions		
None	Ref	—
1	1.29	(1.18–1.41)
2	1.57	(1.43–1.73)
≥3	2.06	(1.89–2.25)
Any CCC	1.20	(1.11–1.30)

Children with sustained high ED use experienced ≥4 ED discharges in 2012 and ≥8 ED discharges in 2013 and 2014 combined. The regression model compares these children to children who also experienced ≥4 ED discharges in 2012 but did not experience 8 or more ED discharges 2013 and 2014 combined. A generalized linear model was used and included all of the covariates listed in Table 1 except the individual CCCs which were excluded because of small sample sizes. CI, confidence interval; —, not applicable.

[a] Reference group is female sex.

[b] Reference group is children not eligible for Medicaid due to a disability.

geographically diverse cohort of Medicaid-insured children was followed across multiple years, allowing for evaluation of ED use to more than 1 ED over time. In our sample, only 16% of high ED users sustained the same high intensity of ED use across all 3 study years. In an evaluation of children receiving care at a single children's hospital accountable care organization, Christensen et al[4] identified that approximately one-third of high ED users continued to use the ED at high levels the following year. Taken together with these results, our study further strengthens the notion that for many Medicaid-insured children, the need for heightened ED services is often temporary. This is a particularly relevant finding for state Medicaid agencies and health plans, given the fact that they often enroll individuals with high ED use in programs to help control or reduce their ED service requirement.[11] In addition, our results extend the existing literature by uniquely describing that children with chronic conditions are at heightened risk for sustaining high levels of ED use over time. Previous research has demonstrated heightened use of ED services by children with chronic conditions in a single year, but less is known about their patterns of ED use over time.[29] The concentration of ED use across many years among children with chronic conditions further supports the importance of enhanced clinical programs for this population. Additionally, wih our study we further enhance our understanding of the reasons why children recurrently visit the ED. Respiratory illnesses, such as asthma and upper respiratory tract infections, predominated the reasons for ED visits among children with sustained high ED use. Prior research has illustrated that many ED visits for respiratory illnesses may be low-acuity, suggesting that gains in resource utilization may be achieved by delivering care in less resource intensity settings such as primary or urgent care.[23]

Consistent with previous evaluations of ED use in children, age,[1,2] and race and/or ethnicity emerged as important demographic risk factors for sustained high-frequency ED use. As in our study, adolescents[30–32] and young children[2,4,20] have been previously recognized as having particularly high levels of ED use. Adolescence may be a period of poor adherence to recommended treatment regimens for chronic conditions, such as asthma, and this may contribute to more frequent exacerbations and ED visits.[33] Moreover, adolescents infrequently receive recommended primary and preventative services, and discontinuity with primary care may contribute to higher ED use for nonurgent conditions (ie, upper respiratory tract infections).[34] Interestingly, in a post hoc analysis (A.P., M.E.S., J.R., et al, unpublished observations), including only children with nonhigh ED use in 2012 (1–3 visits), we found that older age was no longer associated with the future high levels of ED use, suggesting that a history of previous high ED use may be a particularly sensitive marker of future ED use among adolescents. Children who experienced high ED use before the age of 2 years were also more likely to sustain their pattern of high ED use into older age compared with nonadolescent children (between ages 2 and 11 years). These findings suggest that there are characteristics inherent to the child (ie, chronic illness) and/or their caregivers (ie, younger and less experienced parents[35]) that may contribute to some children being more likely to return to the ED as they grow older.[20]

Children with chronic conditions (and in particular, children with multiple chronic conditions) were most likely to have sustained high

levels of ED use. Chronically ill children typically have higher overall requirements for health care services in a year, and these requirements often extend to ED services as well.[29,36–39] For the subpopulation of children with chronic conditions who consistently use the ED at high levels in multiple years, the key next step is to determine which of their ED visits might be avoided with enhanced outpatient care through interventions such as the use of a patient-centered medical home.[13,36,40] Researchers conducting a trial among children with chronic conditions and high health care use observed a significant reduction in ED use among children randomly assigned to a medical home (90 visits per 100 patient years in the medical home group compared with 190 visits in the usual care group).[13] Along with their findings, our results support the need and potential benefit of interventions to reduce persistently high levels of ED use for children with chronic conditions.

In our cohort of Medicaid-insured children, minority children were less likely to experience sustained high ED use than white children. Minority children often experience disparities in access to quality primary care services, which would imply they may rely on the ED for care more frequently.[41–43] However, researchers in previous studies who examined the relationship between race and/or ethnicity and frequency of ED use have often demonstrated conflicting results.[1,4,8,20,44,45] One key difference in our approach that separates it from other studies is that we were able to more comprehensively account for each child's existing conditions through tracking their health care claims 1 year before the index ED visit. Minority children may be more severely impacted by chronic illness and also may not be able to receive timely primary care services to help meet their needs.[41–43] Other important predictors of ED use that may differ on the basis of race and/or ethnicity, including poverty, rural residence, and availability of local health care providers, could not be assessed in this data set.[45–48] We encourage additional studies to better elucidate the important and complex relationship between race and/or ethnicity and sustained high ED use.

There are several limitations which may impact the generalizability of our results. First, the database did not permit state-level identification, which may limit generalizability to states whose eligibility, benefits, and managed care enrollment rates are most reflective of the states included in the analysis. In addition, we required continuous enrollment in Medicaid throughout the entire study period and excluded children who had lapses of >1 month per year in their coverage. We choose this approach because our criteria for high ED use were based on an annual visit count, and we were concerned that if we annualized the outcome variable relative to months of enrollment, we would risk overestimating true ED use. Relaxing our enrollment criteria to include children with 9 or more months of enrollment in Medicaid (rather than 11) yielded no material differences in the patient characteristics associated with sustained high ED use (Supplemental Table 5). Additionally, we categorized chronic conditions on the basis of billing codes, which may underestimate or overestimate the true prevalence of disease because of inaccurate billing and coding. Finally, because of data limitations, we calculated age using the year of birth, limiting our ability to discern between infants of different ages (neonates versus older infants). Future studies are needed to address risk factors for sustained ED use in infancy.

CONCLUSIONS

Our results have implications for child health policy and clinical practice. Policy makers are encouraged to note that for most Medicaid-insured children, the need for heightened ED services is often transient.[4] Overall, few Medicaid-insured children with high ED use in 1 year continue to experience high ED use in future years. When sustained high ED use occurs, it is most prevalent among adolescents and individuals with multiple chronic conditions. Clinicians are encouraged to consider demographic factors, such as age and chronic conditions, in addition to a history of previous ED use when considering enrolling children in enhanced clinical interventions aimed at reducing ED use. Further investigations should focus on characterizing which ED visits may be prevented by providing care in a less resource-intensive care setting or by enrolling children at high risk and adolescents in enhanced medical home programs.

ABBREVIATIONS

aOR: adjusted odds ratio
CCC: complex chronic condition
ED: emergency department
ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification*

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