

# Trends in Health Care Spending for Children in Medicaid With High Resource Use

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abstract

**OBJECTIVES:** To assess characteristics associated with health care spending trends among child high resource users in Medicaid.

**METHODS:** This retrospective analysis included 48 743 children ages 1 to 18 years continuously enrolled from 2009–2013 in 10 state Medicaid programs (Truven MarketScan Medicaid Database) also in the top 5% of all health care spending in 2010. Using multivariable regression, associations were assessed between baseline demographic, clinical, and health services characteristics (using 2009–2010 data) with subsequent health care spending (ie, transiently, intermittently, persistently high) from 2011–2013.

**RESULTS:** High spending from 2011–2013 was transient for 54.2%, persistent for 32.9%, and intermittent for 12.9%. Regarding demographic characteristics, the highest likelihood of persistent versus transient spending occurred in children aged 13 to 18 years versus 1 to 2 years in 2010 (odds ratio [OR], 3.0 [95% confidence interval (CI), 2.7–3.4]). Regarding clinical characteristics, the highest likelihoods were in children with  $\geq 6$  chronic conditions (OR, 4.8 [95% CI, 3.5–6.6]), a respiratory complex chronic condition (OR, 2.5 [95% CI, 2.2–2.8]), or a neuromuscular complex chronic condition (OR, 2.3 [95% CI, 2.2–2.5]). Hospitalization and emergency department (ED) use in 2010 were associated with a decreased likelihood of persistent spending in 2011–2013 (hospitalization OR, 0.7 [95% CI, 0.7–0.7]); ED OR, 0.8 [95% CI, 0.8–0.8]).

**CONCLUSIONS:** Most children with high spending in Medicaid are without persistently high spending in subsequent years. Adolescent age, multiple chronic conditions, and certain complex chronic conditions increased the likelihood of persistently high spending; hospital and ED use decreased it. These data may help inform the development of new models of care and financing to optimize health and save resources in children with high resource use.



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Dr Agrawal conceptualized and designed the study, analyzed and interpreted the data, and drafted the initial manuscript; Dr Hall acquired the data, conducted the initial analyses, analyzed and interpreted the study data, and revised the manuscript for important intellectual content; Dr Cohen, Dr Goodman, Dr Kuo, Ms O'Neill, Dr Thomson, and Dr Neff analyzed and interpreted the

**WHAT'S KNOWN ON THIS SUBJECT:** Clinics, hospitals, care networks, payers, states, and federal agencies are enrolling children with high resource use into programs to improve their health and contain their spending. However, little is known about longitudinal trends in the health care spending of these children.

**WHAT THIS STUDY ADDS:** One-third of children with high spending in Medicaid have persistently high spending in subsequent years. Adolescent age, multiple chronic conditions, and certain complex chronic conditions were strongly associated with persistently high spending; hospital use was inversely associated with persistent spending.

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A small percentage of children in Medicaid consume a large proportion of health care resources; ~5% of children account for ~50% of spending.<sup>1-3</sup> These children with high resource uses are prioritized by the Centers for Medicare and Medicaid Innovation for the development of new models of care (accountable care organizations or regional care coordination networks) to optimize their health and contain their spending.<sup>4-6</sup> These children have a high prevalence of complex chronic conditions with multiple comorbidities, and they often rely on medical technology to maintain their health and functioning.

Little is known about when and how long children in Medicaid incur high health care spending and which patient characteristics are associated with persistent spending. A 2-year study from a previous decade on parent-reported health services in the Medical Expenditure Panel Survey found that one-half of children in the top 10% of spending in 1 year remained so in the subsequent year.<sup>7</sup> In that study, older age, special health care needs, and functional limitations were associated with persistently high spending. Another local-area study of children in a single private health plan reported that children with multiple chronic conditions were most likely to have persistently high utilization over a 4-year period.<sup>8</sup>

More information than what is reported in the earlier literature on specific clinical attributes and health services is needed to distinguish which children are most likely to experience persistently high spending. Such information might help do the following: (1) effectively redesign pediatric health systems to provide high quality of care to children with high resource use; and (2) anticipate trends in health care spending when projecting future payments for high resource users. We therefore conducted the current

study to analyze the longitudinal health resource use and spending of children in Medicaid across multiple states. The objectives were to determine the following: (1) trends in spending among children with high resource use in Medicaid; and (2) associations between patient demographic, clinical, and health services characteristics and trends in spending.

## METHODS

### Study Design and Setting

This article describes a retrospective cohort study of the MarketScan Medicaid Database (Truven Health Analytics, New York, NY). It included 974 843 children ages 0 to 18 years continuously enrolled from 2009–2013 in Medicaid or the Children’s Health Insurance Program fee-for-service and managed care plans from 10 states within all geographic regions of the United States. The strengths of MarketScan Database include data on paid claims for all health care encounters across the care continuum, basis of eligibility for Medicaid, and enrollee demographic and clinical characteristics that have been aggregated and prepared for analysis across multiple states. This study of de-identified data was exempt from review by the institutional review board of the Ann and Robert H. Lurie Children’s Hospital of Chicago.

### Study Population

Among all children continuously enrolled from 2009–2013, those in the top 5% for health care spending in 2010 (index year) were included for analysis. The top 5% threshold was chosen because of the following: (1) it is used in earlier literature of patients with high resource use<sup>9</sup>; and (2) children meeting the threshold accounted for a majority (52.4%) of total Medicaid spending for children in the database. Data from 2009 (ie, the “look-back” year) were used only

to assess chronic conditions of the study population, thus increasing study sensitivity because all chronic conditions may not be coded in a given year. Accordingly, all children were at least 1 year of age in the index year (2010). As a result, neonates, many with unique health care–spending attributes (eg, lengthy and expensive neonatal intensive care hospitalization) in 2010, were not included for analysis. Continuous enrollment was chosen as a criterion for study inclusion because the database does not contain health services and spending that could have occurred during enrollment gaps.

### Outcome Measures

Children with the top 5% most expensive health care spending in 2010 were categorized into 3 mutually exclusive groups based on trends in spending from 2011–2013: (1) transient group, children whose spending fell below the top 5% and did not return to the top 5%; (2) intermittent group, children whose spending fell below but returned to the top 5%; and (3) persistent group, children whose spending consistently remained in the top 5%. We hypothesized that this method of categorization might help distinguish high resource use due to self-limiting illness that resolves or goes into remission, chronic illness that ebbs and peaks with “good” and “bad” epochs, and chronic illness with consistent use of the health care system.

### Demographic and Clinical Characteristics

Demographic characteristics included age, race/ethnicity, sex, Medicaid eligibility (ie, income versus disability) in the 2010 index year. We also assessed the type and number of chronic conditions for each child (documented in 2009 or 2010) with *International Classification of Diseases, Ninth Revision, Clinical Modification*, codes

**TABLE 1** Demographic Characteristics of the Top 5% Children With Highest Medicaid Spending in 2010 According to Their Longitudinal Trends in Spending From 2011–2013

Characteristic	Overall (N = 48 743), %	Trends in High Resource Use			P <sup>a</sup>
		Transient <sup>b</sup> (n = 26 428), %	Intermittent <sup>c</sup> (n = 6301), %	Persistent <sup>d</sup> (n = 16 041), %	
Age, y <sup>e</sup>					
1–2	7.4	9.6	5.9	4.3	<.001
3–4	10.5	12.3	9.8	7.7	
5–12	44.7	42.8	44.6	47.7	
≥13	37.5	35.2	39.7	40.3	
Female	42.3	44.1	44.3	38.6	<.001
Race/ethnicity					
Non-Hispanic white	48.9	47	47.1	52.6	<.001
Non-Hispanic black	26.0	29.8	25.8	19.6	
Hispanic	4.7	5.7	4.1	3.4	
Other	20.4	17.5	23	24.3	
Medicaid eligibility					
Disability	39.1	28.4	40.9	56.0	<.001
Other	60.9	71.6	59.1	44.0	

<sup>a</sup> P values are obtained from a  $\chi^2$  test comparing the prevalence of the characteristic of interest across the spending groups.

<sup>b</sup> Children whose spending fell below the top 5% in a subsequent year and did not return to the top 5% during the study period.

<sup>c</sup> Children whose spending did not meet the top 5% threshold in a subsequent year did eventually return to the top 5% (eg, below the 5% threshold in 2011 and above it in 2012).

<sup>d</sup> Children whose spending remained in the top 5% consistently from 2011–2013.

<sup>e</sup> Age was assessed in year 2010.

by using the following: (1) the Agency for Healthcare Research and Quality Chronic Condition Indicator system to enumerate the existence and number of chronic conditions<sup>10</sup>; and (2) the classification by Feudtner et al<sup>11</sup> to enumerate those complex chronic conditions known to be associated with high morbidity and resource use that often necessitate specialized/tertiary care. Multiple years (ie, 2009 and 2010) were used to assess chronic conditions based on recommendations from national experts on diagnosis classification schemes of health administrative data.<sup>12,13</sup> *International Classification of Diseases, Ninth Revision, Clinical Modification*, codes were also used to assess medical technology (eg, gastrostomy, tracheostomy), defined as medical devices used to optimize health and functioning.<sup>14,15</sup>

### Health Care Spending

Health care spending was assessed in 8 mutually exclusive service categories: emergency department (ED), home health, inpatient, mental health, pharmacy outpatient, primary care, specialty outpatient care, and “other” services (eg, physical

therapy). The mental health category included inpatient and outpatient health services.

### Data Analysis

In bivariate analysis, demographic, clinical, and health services characteristics were compared across the 3 spending groups (transient, intermittent, and persistent) by using  $\chi^2$  tests. In multivariable analysis, 2 generalized logit models were developed to assess the relationship of the same characteristics with the likelihood of persistent or intermittent high spending compared with transient spending. Children with transient high resource use were chosen as the reference group because we anticipated their spending to be self-limited and thus lower than the other groups. SAS version 9.4 (SAS Institute, Inc, Cary, NC) was used for all analyses, and statistical significance was set at  $P < .01$  due to large sample sizes.

## RESULTS

### Study Population

There were 48 743 children in the top 5% of 2010 health care

spending. These children accounted for 52.4% (\$1.4 billion) of spending for all children continuously enrolled in Medicaid in 2010. Their median age in 2010 was 10 years (interquartile range, 6–14 years); 48.9% were non-Hispanic white, and 39.1% were enrolled in Medicaid because of a disability (Table 1). Among the children, 13.2% had 1 chronic condition and 84.9% had  $\geq 2$  chronic conditions of any complexity (using the chronic condition indicator method); 51.3% had  $\geq 1$  complex chronic condition and 26.1% had  $\geq 2$  chronic conditions (using the complex chronic condition method); and 10.9% were assisted with medical technology (Table 2).

### Spending Groups

Of the children in the top 5% of 2010 Medicaid spending, 54.2% ( $n = 26\,428$ ) fell below the top 5% and did not return to the top 5% in 2011–2013 (ie, transient group); 32.9% ( $n = 16\,014$ ) were persistently in the top 5% of spending (ie, persistent group); and 12.9% ( $n = 6301$ ) fell below the top 5% and returned to the top 5% (ie,

**TABLE 2** Clinical and Health Service Characteristics of the Top 5% Children With the Highest Medicaid Spending in 2010 According to Their Trends in Subsequent Spending From 2011–2013

Characteristic	Overall (N = 48 743), %	Trends in High Resource Use			P <sup>a</sup>
		Transient <sup>b</sup> (n = 26 428), %	Intermittent <sup>c</sup> (n = 6301), %	Persistent <sup>d</sup> (n = 16 014), %	
No. of chronic conditions <sup>e</sup>					
0	1.8	2.9	1.0	0.3	<.001
1	13.2	16.6	10.8	8.5	
2	21.6	24.4	21	17.2	
3	20.9	21.9	22.2	18.8	
4	15.3	14.4	17.3	16.1	
5	10.7	9.2	11.6	12.9	
≥6	16.4	10.5	16.2	26.2	
Complex chronic conditions <sup>e</sup>					
Any	51.3	41.8	52.7	66.4	<.001
Type					
Neuromuscular	24.6	15.0	23.5	40.9	<.001
Malignancy	16.1	14.1	15.4	19.5	
Congenital/genetic	12.2	8.3	11.8	18.7	
Cardiovascular	11.0	8.8	12.0	14.2	
Gastrointestinal	9.4	5.5	7.7	16.6	
Metabolic	7.7	5.4	6.8	11.9	
Hematologic/immunologic	6.3	4.6	7.8	8.5	
Respiratory	4.3	2.4	2.9	8.2	
Renal	4.0	2.6	3.6	6.3	
Neonatal	2.3	1.6	1.8	3.5	
Transplant	1.1	0.6	0.9	2.1	
Technology assistance	10.9	6.3	8.3	19.7	
Health services use <sup>f</sup>					
Mental health	68.5	63.0	69.5	77.2	<.001
ED	49.3	51.8	52.8	43.8	
Hospital	38.3	41.9	41.1	31.2	
Home health	8.4	4.5	7.6	15.0	

<sup>a</sup> P values are obtained from a  $\chi^2$  test comparing the prevalence of the characteristic of interest across the spending groups.

<sup>b</sup> Children whose spending fell below the top 5% in a subsequent year and did not return to the top 5% during the study period.

<sup>c</sup> Children whose spending did not meet the top 5% threshold in a subsequent year but did eventually return to the top 5% (eg, below 5% threshold in 2011 and above it in 2012).

<sup>d</sup> Children whose spending remained in the top 5% consistently from 2011–2013.

<sup>e</sup> Clinical characteristics were identified in years 2009 or 2010.

<sup>f</sup> Shown are the percent of children using the health service at least once in 2010.

intermittent group). Of the total cohort health care spending from 2010–2013, 64.8% was attributed to the persistent group, 9.9% to the intermittent group, and 25.3% to the transient group.

### Demographic Characteristics of the Spending Groups

Age, race/ethnicity, and basis of Medicaid eligibility varied significantly ( $P < .001$ ) across the spending groups (Table 1). Children with persistent spending were older; the percentage of children aged 13 to 18 years increased significantly ( $P < .001$ ) across the transient (35.2%), intermittent (39.7%), and persistent (40.3%) groups. The percentage of non-Hispanic black

children decreased significantly ( $P < .001$ ) across the transient (29.8%), intermittent (25.8%), and persistent (19.6%) groups. The percentage of children enrolled due to a disability increased significantly ( $P < .001$ ) across the transient (28.4%), intermittent (40.9%), and persistent (56.0%) groups.

### Clinical Characteristics Across Spending Groups

The type and number of chronic conditions varied significantly ( $P < .001$ ) across spending groups (Table 2). For example, the percentage of children with  $\geq 6$  chronic conditions (of any complexity) increased significantly ( $P < .001$ ) across the

transient (10.5%), intermittent (16.2%), and persistent (26.2%) groups. The percentage of children with  $\geq 1$  complex chronic condition also increased significantly ( $P < .001$ ) across the transient (41.8%), intermittent (52.7%), and persistent (66.4%) groups. The percentage of children with a neuromuscular complex chronic condition, the most common of all complex chronic conditions, increased significantly ( $P < .001$ ) across the transient (15.0%), intermittent (23.5%), and persistent (40.9%) groups. The percentage of children assisted with medical technology also increased significantly ( $P < .001$ ) across the transient (6.3%), intermittent (8.3%), and persistent (19.7%) groups.

## Health Services Characteristics Across Spending Groups

Use of hospital, ED, mental health, and home health services in the 2010 index year varied significantly ( $P < .001$ ) across spending groups (Table 2). The proportion of children hospitalized at least once was similar for the transient (41.9%) and intermittent (41.1%) groups but lower for the persistent group (31.2%;  $P < .001$ ). Similarly, the proportion of children with 1 or more ED visits was similar for the transient (51.8%) and intermittent (52.8%) groups but lower for the persistent group (43.8%) ( $P < .001$ ). The percentage of children using mental health services increased significantly ( $P < .001$ ) across the transient (63.0%), intermittent (69.5%), and persistent (77.2%) groups. The percentage of children using home health services also increased significantly ( $P < .001$ ) across the transient (4.5%), intermittent (7.6%), and persistent (15.0%) groups.

The distribution of spending in 2010 across health services for the 3 spending groups was similar aside from inpatient care, specialty care, and medications. Compared with the transient and intermittent spending groups, the persistent group had a lower percentage of spending on inpatient care (29% vs 42%–44%) and a higher percentage of spending on specialty care (17% vs 7%–8%) and medications (15% vs 7%) ( $P < .001$  for all) (Supplemental Fig 4A). Across all groups, the least amount of 2010 spending occurred with ED care (range, 1% [persistent group] to 2% [transient and intermittent groups] and primary care (1% for all groups). For all spending groups, the percentages of health care spending for each of the health services stayed relatively constant through 2013. From 2010–2013, patients in the persistent group were responsible for the majority of home health (84.5%), specialty (80.2%),

pharmacy (75.9%), and inpatient (59.4%) spending. Transient patients were responsible for the largest proportion of ED (45.5%) and primary care (49.8%) spending (Supplemental Fig 4B).

## Multivariable Analysis of Spending Groups and Patient Characteristics

In multivariable analysis, the highest likelihood of persistent versus transient high resource use was observed in children with  $\geq 6$  chronic conditions (odds ratio [OR], 4.8 [95% confidence interval (CI), 3.5–6.6]) (Fig 1) and children aged 13–18 years versus 1–2 years in 2010 (OR, 3.0 [95% CI, 2.7–3.4]) (Fig 2). The same characteristics had the highest likelihood of intermittent versus transient resource use but with a smaller effect: children with  $\geq 6$  chronic conditions (OR, 2.5 [95% CI, 1.9–3.2]) and children with baseline age 13–18 years versus 1–2 years (OR, 1.8 [95% CI, 1.6–2.1]).

The complex chronic condition groupings associated with the highest likelihood of persistent versus transient high resource use were respiratory (OR, 2.5 [95% CI, 2.2–2.8]) and neuromuscular (OR, 2.3 [95% CI, 2.2–2.5]) (Fig 1). The complex chronic condition groupings associated with the highest likelihood of intermittent versus transient high resource use were hematologic/immunologic (OR, 1.6 [95% CI, 1.4–1.8]) and neuromuscular (OR, 1.4 [95% CI, 1.3–1.5]). Home health care was the health service with the highest likelihood of persistent versus transient high health resource use (OR, 2.5 [95% CI, 2.3–2.7]) and intermittent versus transient high resource use (OR, 1.6 [95% CI, 1.4–1.8]) (Fig 3).

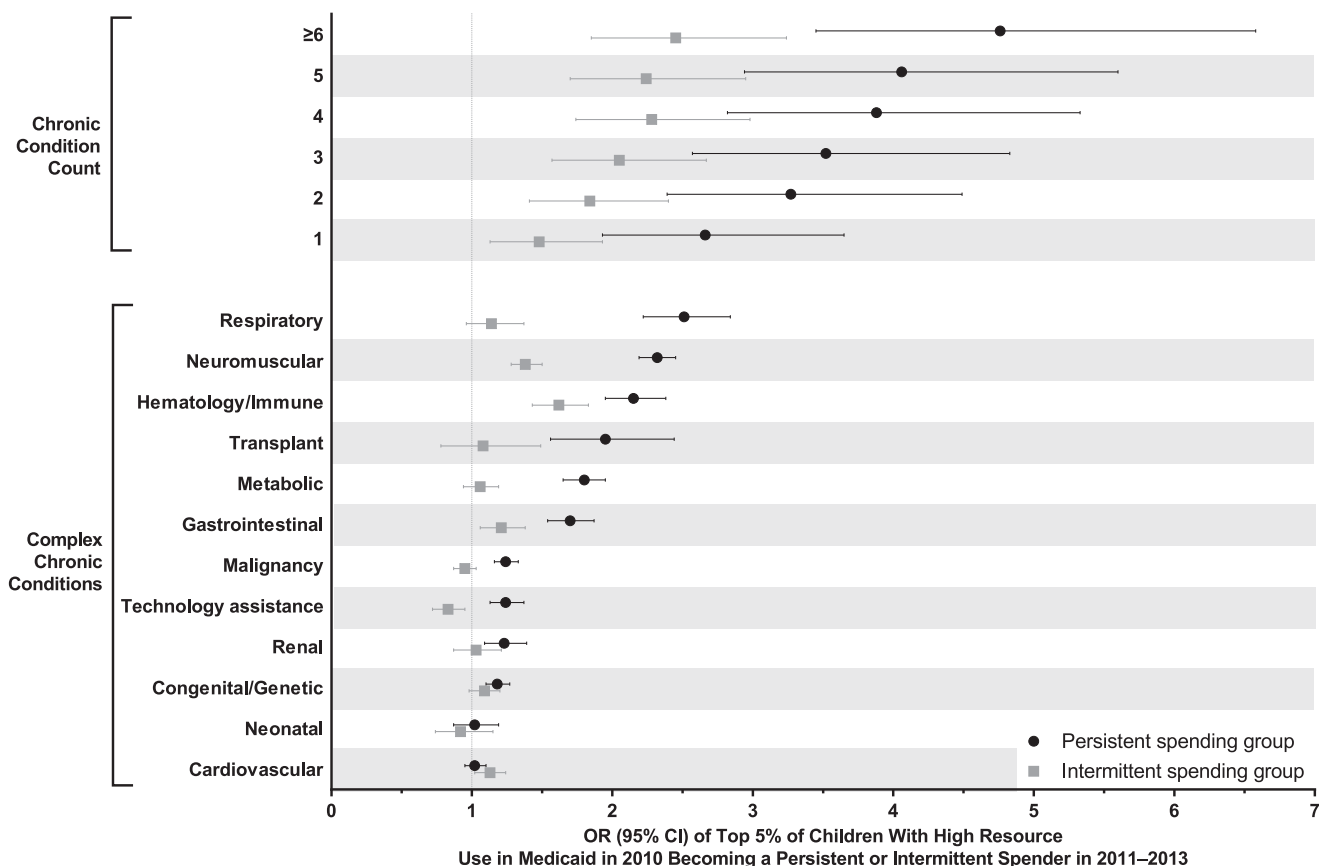
The lowest likelihood of persistent versus transient high resource use was observed in non-Hispanic black (OR, 0.7 [95% CI, 0.6–0.7]) and Hispanic children (OR, 0.6 [95% CI, 0.5–0.7]) compared with non-Hispanic white children (Fig

2). These children also had a lower likelihood of intermittent versus transient resource use but with a smaller effect: non-Hispanic black (OR, 0.9 [95% CI, 0.8–1.0]) and Hispanic (OR, 0.8 [95% CI, 0.7–1.0]). Children who were hospitalized or visited the ED during their 2010 high resource year also had a lower likelihood of persistent versus transient high resource use (hospitalization OR, 0.7 [95% CI, 0.7–0.7]); ED OR, 0.8 [95% CI, 0.8–0.8]) (Fig 3). Hospitalization and ED use in 2010 was associated with a higher likelihood of intermittent versus transient high resource use (hospitalization OR, 1.1 [95% CI, 1.0–1.1]; ED OR, 1.1 [95% CI, 1.0–1.1]).

## DISCUSSION

The current study reports new findings about trends in health care spending for children in Medicaid. We found that one-third of children continuously enrolled in 10 state Medicaid programs with high spending in 2010 experienced subsequent high spending persistently for the next 3 years. The highest likelihood of subsequent high spending was observed in older children with many chronic conditions, respiratory or neuromuscular complex chronic conditions, and those who used home health services. Decreased likelihood of subsequent high spending was observed in children with hospital or ED use in 2010.

The current study complements earlier research on health care spending trends for children. Liptak et al<sup>7</sup> reported that one-half of the 10% of children with highest resource use in 2000 persisted in the top 10% in 2001. Similarly, we found that nearly one-half of the 5% of children in Medicaid with highest resource use reached the top 5% (either persistently or intermittently) in the subsequent 3 years. Some might find this percentage high,



**FIGURE 1**

Multivariable analysis of baseline clinical characteristics and the likelihood of experiencing persistent or intermittent high health care spending compared with transient spending. Shown are the adjusted ORs and 95% CIs of persistent and intermittent 2011–2013 spending compared with transient 2011–2013 spending among children in Medicaid with high resource use with clinical characteristics identified in 2009–2010.

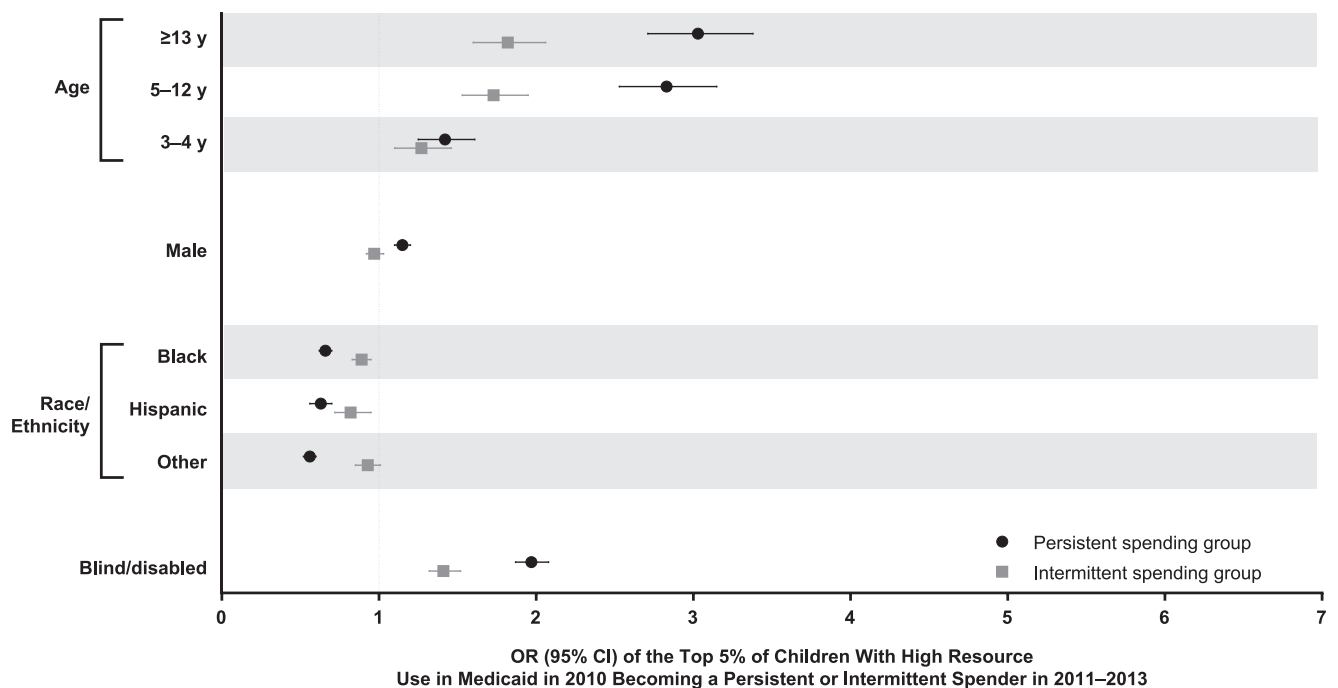
thereby justifying targeting and help for all children with high resource use. Others might find the percentage low, justifying targeting and help for only the children who are the most likely to experience persistent high resource use. Regardless of the interpretation, the emerging literature seems consistent that persistently high spending is not guaranteed for most children.<sup>16</sup>

Understanding the clinical attributes of children most likely to experience persistent high resource use might help inform clinical approaches to optimize their health. Similar to our findings, Zhong et al,<sup>8</sup> in a local-area study, also reported a strong correlation between a large number of chronic conditions and the likelihood of continued high resource use. Our findings

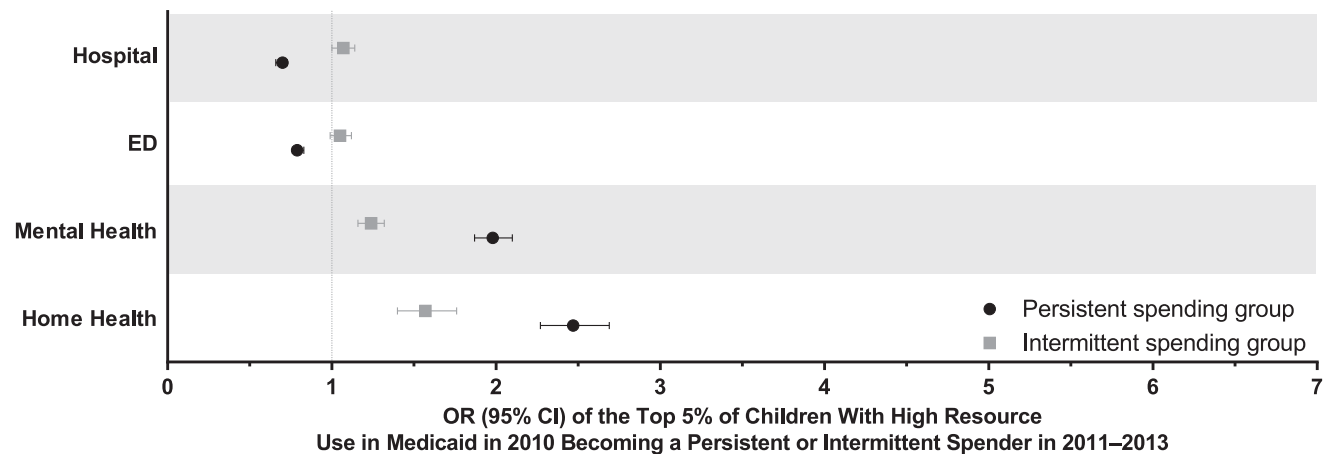
additionally highlight specific chronic conditions, including complex neuromuscular (eg, cerebral palsy) and respiratory (eg, cystic fibrosis) ones, which affected the likelihood of persistent spending the most. Previous literature and our own clinical experience suggest that children with multiple chronic conditions, especially those with a neuromuscular condition, are at risk for underuse of primary care, lack of a health care provider taking charge of their care, major unmet health care needs, and a hefty care coordination and caregiving burden placed on their families.<sup>17–23</sup> Perhaps population health initiatives (eg, enhanced medical homes or neighborhoods for children with medical complexity, complex care networks) designed to alleviate these specific issues might benefit children

who are the most likely to have persistent high resource use.

The findings of hospital and ED use on persistent spending use warrant further contextualization. Hospital and ED use are routinely targeted for reduction in patients with high resource use because, presumably, they are largely responsible for it and because, sometimes, that use is unnecessary. Some clinical programs set high use of hospital care (eg, with recurrent readmissions) as a criterion to identify, enroll, and help patients with high resource use. Our finding that hospital use was negatively associated with persistently high health care spending aligns with recent research reporting the transient use of hospital care in children.<sup>16</sup> Most children with high inpatient



**FIGURE 2** Multivariable analysis of baseline health services characteristics and the likelihood of experiencing persistent or intermittent high health care spending compared with transient spending. Shown are the adjusted ORs and 95% CIs of persistent and intermittent 2011–2013 spending compared with transient 2011–2013 spending among children in Medicaid with high resource use in 2010. Use of the health services contained in the figure occurred in 2010.



**FIGURE 3** Multivariable analysis of patient demographic characteristics in 2010 and the likelihood of experiencing persistent or intermittent high health care spending. Shown are the adjusted ORs and 95% CIs of persistent and intermittent 2011–2013 spending compared with transient 2011–2013 spending among children in Medicaid with high resource use with various demographic characteristics in the 2010 baseline year.

costs are not hospitalized again in subsequent years. It remains unknown which reasons best explain this finding. Some of the children could have received better care coordination after their hospital use, which improved their health. Others may have experienced a cluster of hospitalizations for a health

problem (eg, oromotor dysfunction and aspiration) that ultimately resolved with a major medical intervention (eg, gastrostomy). Transient hospital use might help clarify why hospital care in the current study accounted for only ~25% of spending on children with persistently high resource use. In

contrast, hospital care accounts for the majority (ie, 60%) of spending for the top 5% most expensive Medicare beneficiaries.<sup>9</sup>

Closer examination of health services responsible for persistently high spending in children with Medicaid may be necessary to assess

opportunities for health optimization and cost containment. Mental health services, specialty outpatient care, and medications accounted for the majority of expenditures in children with persistently high spending. The administrative data from the current study are not positioned to assess the value, appropriateness, or the reducibility of the spending across these health services; subsequent studies with different methods (eg, chart review, survey) may be necessary to measure those attributes. Previous studies report both underuse and overuse of mental health services in children.<sup>24</sup> Similarly, some studies report a severe shortage of pediatric subspecialists with significant barriers to specialty access for children in Medicaid,<sup>25–27</sup> whereas another study suggests that there might be overuse of pediatric specialists in some geographic areas.<sup>28</sup> There is a paucity of information on medication use in child high resource users. Although some medications are known to be extremely expensive (eg, factor replacement therapy for hemophilia<sup>29</sup>), little is known about unnecessary polypharmacy or use of medications with limited efficacy. Further investigation is necessary to determine whether children with persistently high resource use are receiving the right amount of mental health, specialty, and medication health services at the highest value possible.

This study has several limitations. A widely accepted definition of persistent health care spending does not exist; different definitions may lead to different findings. Administrative data contain insufficient clinical information to assess the reasons for the spending trends. Spending trends in neonates cannot be determined from this study because they were not included. The large sample size of patients in the current study led to a high level of statistical power; some statistically significant findings had modest effect sizes (eg, Hispanic ethnicity and persistent spending).

The data usage agreement precludes identification of the US states included in the Truven database; specific attributes of a state's Medicaid program (eg, expansion under the Patient Protection and Affordable Care Act) cannot be determined. Absent nationally representative Medicaid data, the generalizability of the results to all child Medicaid users is unknown. The findings may not generalize to children with private insurance or to children with less continuous enrollment in Medicaid. In the data set, one-fifth and one-third of children eligible for Medicaid with a disability versus without a disability, respectively, were not continuously enrolled. There may be variation in the categorization of Medicaid spending across states or in the utilization of resources by state, local area, or institution.<sup>30</sup> Some health

services may be funded under a payment system other than Medicaid (eg, education), leading to potential undercounting of spending on them.

## CONCLUSIONS

Despite the aforementioned limitations, the results of the current study may be useful when considering how to optimize health and contain spending of children with high resource use. Continued high health care spending among children in Medicaid is not guaranteed; one-half of these children will experience subsequent high spending (either persistently or intermittently) and the other one-half will not. Thus, there may be significant regression to mean spending to account for when assessing the impact of interventions on spending trends over time. Some initiatives may then choose to shift focus on predicting which children will experience high resource use in the first place. Understanding that hospital and ED health services are negatively associated with persistently high spending, initiatives may benefit from assessment of outpatient and community health services that are driving persistently high spending.

## ABBREVIATIONS

CI: confidence interval  
ED: emergency department  
OR: odds ratio

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study data and revised the manuscript for important intellectual content; Dr Berry conceptualized and designed the study, analyzed and interpreted the data, and drafted the manuscript; and all authors approved the final manuscript as written.

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