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ARTICLE

Short-term Persistence of High Health Care Costs in a Nationally Representative Sample of Children

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ABSTRACT

OBJECTIVES. Little is known about the persistence of health care costs in children. Determining whether children with high health expenses continue to have high expenses over time can help in the development of targeted programs and policies to decrease costs, plan equitable health insurance strategies, and provide insights into the effects of costly conditions on families. The objectives of this study were to (1) identify the characteristics of children who are in the top 10th percentile for health costs, (2) investigate whether those in the top percentiles for costs in 1 year continue in the same percentiles the next year, and (3) identify factors that predict whether a child stays in the top percentiles.

METHODS. Data from 2 consecutive years (2000–2001) of the Medical Expenditure Panel Survey were analyzed. Changes in a child's position in the expenditure distribution were examined. An estimated multivariate model conditional on insurance was developed to predict the true resource costs of providing services. Statistical analyses, including logistic-regression and multivariate linear-regression modeling, were done to account for the weighted sampling used in Medical Expenditure Panel Survey.

RESULTS. A total of 2938 children were included in the survey for both years. In 2000, the top 10% of the children accounted for 54% of all costs. They had a mean total expenditure of $6422 with out-of-pocket expenditures of $1236; 49% of the children in the top decile in 2000 persisted in the top decile in 2001, whereas 12% dropped into the bottom half. Children who had been in the top 10% in 2000 were 10 times more likely than other children to be in the top 10% for 2001. Other characteristics in 2000 that predicted membership in the top decile for 2001 included age (11–15 and 16–17 years), having any insurance (public and private), being positive on the standardized Children With Special Health care Need screener, and having a functional limitation.

CONCLUSIONS. Almost half of the children in the top 10% for costs in 2000 persisted in the top 10% in 2001. Older children, children with special health care needs, and children with functional limitations were more likely to be in the top decile.

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Key Words
health expenditures, child health services, chronic disease, health care surveys

Abbreviations
MEPS—Medical Expenditure Panel Survey
ICD-9-CM—*International Classification of Diseases, Ninth Revision, Clinical Modification*
CSHCN—children with special health care needs
ED—emergency department

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These findings do not support the belief that black and Latino children who are on Medicaid account for a disproportionate share of costs or expenditures. Because the children who were among the top 10% used health care services in a variety of inpatient, emergency department, outpatient, and ancillary venues, providing care coordination throughout the entire health care system is important to address both the cost and the quality aspects of health care for the most costly children. Targeted programs to decrease expenditures for those with the greatest costs have the potential to save future health care dollars. Assessment of the factors that predict persistence of high expenditures can be used to help in the planning of equitable health insurance strategies such as catastrophic care, carve-outs, reinsurance, and risk adjustment. Clinicians should review regularly the extent of care coordination that they are providing for their high-need and high-cost patients, especially preteens and adolescents. Studies that examine the persistence of expenditures over longer periods and include assessment of quality of care are needed.

RELATIVELY SMALL NUMBERS of children account for a large share of health care expenditures. For example, in a study that used the Medical Expenditure Panel Survey (MEPS) for 1996–1998, McCormick et al[1] found that the top 10% of child health care spenders accounted for 69% of all pediatric dollars spent on health care. Similarly, in a study of children who had chronic illnesses and were enrolled in the Washington State Medicaid program in 1993, Ireys et al[2] reported that 10% of children accounted for ~70% of the payments. A small proportion of children who are on Supplemental Security Income account for very large proportions of Medicaid expenditures.[3]

Despite these findings, little is known about the persistence of health care costs in children. Do children who account for the top percentiles of expenditures persist in these top percentiles from 1 year to the next? Persistence in the top deciles of expenditures may be distributed randomly and unpredictably (eg, as a result of injuries), or it may be related to characteristics of the child (eg, demographics, chronic medical condition) or to previous expenditures (eg, previous position in the expenditure distribution) and, therefore, would be predictable.

Information about the persistence of children's health care costs is important to know for several reasons, both from an individual and a population perspective. If children with high health expenses maintain high expenses over time, then targeted programs to decrease costs[4,5] and to support families can be developed. Information on factors that predict persistence of high expenditures can be used to help in the planning of equitable health insurance strategies, such as catastrophic care, carve-outs, reinsurance, and risk adjustment,[6,7] or to plan benefits and tax credits. Variability and predictability of health costs are important for insurers, including Medicaid; highly variable, unpredictable sectors might cause insurers to leave a particular market.

This information also has implications for policy makers. It can help planners decide whether it is more economical to have strategies that would alter the care received by a larger percentage of the population,[8,9] such as increasing the use of generic drugs,[10] and encouraging large numbers of people to use services more prudently, or to focus on those with high-cost conditions.[11,12]

This study analyzed the persistence of health care costs of a nationally representative sample of children. The objectives were to (1) identify characteristics of children who are in the top 10% of health costs, (2) investigate whether those in the top percentiles for costs in 1 year continue in the same percentiles in the next year, and (3) identify demographic and health-related factors that predict whether a child remains in the top percentiles. We hypothesized that a significant percentage of children who were in the top percentiles in 1 year would remain in the top percentiles in the next year. Evidence from adults supports this view.[13] Also, claims-based as well as risk-adjusted models to predict health expenditures have been shown to be valid,[6,14] suggesting that children who have high expenses in 1 year continue having high expenses in the next year(s). We hypothesized that children with special health needs would be more likely to persist in the top percentiles.[2,15] We also hypothesized that high expenditures for infants would be less stable than those for older children and adolescents because health care encounters for high-risk neonates typically decrease after the first year of life.[16–18]

METHODS

Design and Source of Data

This study is an analysis of children who lived in households that were surveyed in 2000 and 2001 by the MEPS.[19] Children who had data for these 2 consecutive years were analyzed. The MEPS Household Component survey is a nationally representative survey of the civilian noninstitutionalized population of the United States that includes medical expenditure data at both person and household levels. The Household Component uses an overlapping panel design in which a new panel is selected each year and is surveyed over a 2.5-year period. The sampling frame for the MEPS Household Component is drawn from respondents to the National Health Interview Survey, which provides a nationally representative sample of the US civilian, noninstitutionalized population with oversampling of Hispanic and black households. The MEPS Medical Provider Component is a follow-back survey that collects data from medical providers and pharmacies that are used by the study sample. Expenditure data that are collected in the

Medical Provider Component are used to improve the overall quality of head-of-household reported expenditure data in this survey. The MEPS lists *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes but only the first 3 digits.

All dollars were converted to 2000 dollars.[20] Whether a child had special health needs was determined in 2 ways: (1) by using the children with special health care needs (CSHCN) screener,[21] which was part of the MEPS for 2000 and 2001, and (2) by using a list of ICD-9-CM codes that were developed for a previous study.[22] We used both classifications because they were developed for different purposes (the ICD-9-CM list was designed specifically for financial analyses, whereas the screener was designed for general classification) and because interest remains in both methods. Because it is the most commonly used cut point, 10% was used to identify those with the greatest costs (see Appendix 1).

Subjects

Data were analyzed for children who were younger than 18 years and for whom complete information was available for both years.

Measures

Variables that were analyzed included demographic information and information regarding insurance coverage. Information on expenditures included hospital inpatient and outpatient services, other ambulatory services, dental services (which includes orthodontia), prescription medications, diagnostic tests, medical equipment and supplies, medical care provided at home, and out-of-pocket expenses. Functional limitations were identified by a question on the survey. Outcome measures included expenditures and estimated costs from medical claims that were included in the expenditure file, converted to 2000 dollars.

Analyses

Complete data for 2000 and 2001 were available for 2938 children who were younger than 18 years. Statistical analyses, including logistic-regression and multivariate linear-regression modeling, were done in SUDAAN[23] and Stata[24]; both programs account for the weighted sampling used in MEPS. The data presented are weighted to produce nationally representative estimates of the noninstitutionalized population of children for 2000.

Cost Model

The information from MEPS chronicles the flow of actual expenditures and reflects the nature of discounts that are available to each private and public payer. Therefore, MEPS does not report true resource costs. Individuals who are uninsured or have Medicaid typically pay less for the same services as those who have private insurance.[25] For instance, if Medicaid pays 40 cents compared with $1 from a private insurance company for the same service, then individuals with Medicaid would be underrepresented in the group that composes the top 10% of expenditures, although their use of services is the same. Although MEPS does include "charges," this also is unlikely to reflect true resource costs because charges for the same visit or procedure vary among locations. We therefore developed an estimated multivariate model conditional on insurance to predict the true resource costs of providing services and to convert these expenditure flows to a common metric. Therefore, individuals with different types of insurance (or no insurance) would be more comparable to each other. Separate equations were used to convert inpatient and outpatient expenditures. The variables that were used for predicting inpatient and outpatient costs are shown in Appendices 2 and 3, respectively.

The true resource costs of providing services were estimated with multivariate linear regression models. We estimated the cost of each medical encounter by modeling the known expenditures for the 8 unique events captured in MEPS (outpatient [hospital based and office based], emergency department [ED] visits, prescriptions, inpatient, dental, medical equipment, and home based), controlling for insurance type, age, and gender. Inpatient visits also were controlled for surgeries, length of stay, and length of stay squared. The predicted estimates for each encounter then were summed for each person to give an overall estimated cost of medical services for that person for that year. Similar models have been used in other studies to estimate true costs.[26–28] For example, length of stay squared is used because this variable allows for nonlinearity in pricing related to the length of stay. Many studies have shown that more intense and expensive treatment generally takes place in the early days after a patient's admission, and length of stay squared allows for the impact of this phenomenon to be captured.[28] The Appendix shows the variables that were used in 2 of the 8 models, 1 for inpatient costs and the other for prescription costs, as well as the results of their ordinary least-squares analyses.

RESULTS

A total of 2938 children had valid data for both 2000 and 2001. Of these 48% were female; 15% had a special health care need identified by the CSHCN screener; 5% were younger than 1 year, whereas 29% were 11 to 17 years of age; 17% were Hispanic and 15% were Black, non-Hispanic; and 17% were below the poverty level, whereas 28% were at >400% of the poverty level. Seventy percent had private insurance for at least 1 month, whereas 21% had only public insurance.

Table 1 shows annual expenditures and utilization in 2000 and 2001. The mean (SE) total expenditures for those in the top 10% in 2000 was $6422.19 ($1124.95), with median total expenditures of $3463. The range was from $1694 to $140 030. Itemized expenditures in-

TABLE 1 **Mean and Median Annual Expenditures and Utilization in 2000 and 2001 for All Children and for Children Who Were in the Top Decile Cohort in 2000**

Characteristics in 2000	2000		2001	
	Top 10% in 2000, mean (SE) median ($n = 249$)	All Children, mean (SE) median ($n = 2938$)	Follow-up of Children Who Were in top 10% in 2000, mean (SE) median ($n = 249$)	All Children, mean (SE) median ($n = 2938$)
Expenditures				
Total expenditures	$6422.19 ($1124.95) $3463	$922.43 ($123.98) $213	$2462.71 ($548.03) $720	$763.75 ($69.91) $221
Self-pay expenditures	$1235.89 ($142.81) $559	$216.31 ($20.60) $38	$400.71 ($44.71) $111	$185.21 ($10.99) $32
Utilization				
Hospital discharges	0.24 (0.04) 0	0.03 (0.005) 0	0.06 (0.02) 0	0.03 (0.004) 0
Nights in hospital for discharges	1.55 (0.72) 0	0.17 (0.08) 0	0.25 (0.11) 0	0.12 (0.05) 0
Outpatient visits	16.05 (1.84) 10	4.55 (0.26) 3	12.82 (1.28) 7	4.41 (0.22) 2
Office-based provider	8.20 (0.89) 4	2.76 (0.14) 1	6.96 (0.91) 3	2.68 (0.16) 1
Outpatient provider	0.78 (0.20) 0	0.13 (0.02) 0	0.31 (0.10) 0	0.11 (0.02) 0
ED	0.37 (0.05) 0	0.17 (0.01) 0	0.26 (0.05) 0	0.16 (0.01) 0
Home health provider days	3.03 (1.79) 0	0.31 (0.18) 0	1.83 (0.94) 0	0.19 (0.09) 0
Dental	3.68 (0.32) 2	1.18 (0.07) 0	3.47 (0.35) 1	1.28 (0.07) 0
Prescription medications, including refills	6.05 (0.74) 3	2.17 (0.11) 1	5.27 (0.58) 2	2.19 (0.12) 0

cluded the following: inpatient, $1913.27 ($814.77); dental (including orthodontia), $1783.24 ($204.48); home health, $980.99 ($767.24); office-based provider, $626.31 ($69.86); outpatient provider, $518.52 ($140.96); prescriptions, $342.59 ($69.94); ED, $206.99 ($48.22); and durable medical equipment/supplies, $50.29 ($7.84). Their mean self-pay was $1235.89. They averaged 1.55 nights in the hospital, 16 outpatient visits, and 6 prescriptions. By 2001, the mean (SE) total expenditures of the cohort of children who had been in the top decile in 2000 had decreased to $2462.71 ($548.03), with a median of $720 and a range of $0 to $52 478. Within the top 10%, mean expenditures increased as expected. For example, among the top 5% ($n = 121$), mean total expenditures in 2000 were $10 260 (SE: $2022), and among the top 1% ($n = 24$), they were $28 724 (SE: $9059). Appendix 1 shows the distribution of total expenditures for each percentile of the top 10%.

The most common reasons for visits (but not the bulk of the costs) for the children in the top 10%, based on ICD-9-CM codes, included upper respiratory infection (8.0% in 2000), gastrointestinal infection (5.3%), otitis media (5.0%), allergic rhinitis (3.8%), and HIV infection (2.9%). These reflect that children with chronic or serious high-cost problems still have frequent common, minor illnesses. Because MEPS releases only the first 3 digits of the ICD codes, additional elucidation of diagnoses (eg, identifying injuries) was not possible.

All analyses were performed using expenditures as well as the multivariate model of costs. The remainder of the findings, however, are presented using costs, with data on expenditures presented only when any major differences between the 2 methods occur. Tables that show data using both methods of analyses are available by contacting the first author.

As shown in Table 2, children in the top 10% in 2000 accounted for 54% of all costs. The top 25% accounted for 76% of all costs. The bottom 50% accounted for only 8% of the total costs expended. The same pattern was noted for 2001.

Table 3 shows demographic and health characteristics of the children who were in the top decile for costs for 2000. Compared with the other children, children in the top decile were more likely to be between the ages of 11 and 15 years (45% vs 25%; $P < .001$; and less likely to be between 1 and 5 years). They also were more likely to have special health care needs (35% vs 13% using the CSHCN screener; $P < .001$) and to be white, non-Hispanic (83% vs 62%; $P < .001$). They also were more likely to be affluent (poverty status $400% [40% vs 27%; $P = .01$]) and to have functional limitations (8% vs 2%; $P = .001$). They were less likely to be uninsured

TABLE 2 **Costs for 2000 and 2001 (in 2000 Dollars) for Children in Various Percentiles for Each Year**

Percentile (Weighted)	Costs					
	2000			2001		
	n	% of All Costs	Cost Threshold	*n*	% of All Costs	Cost Threshold
Top 10%	250	53.6	≥$2159	248	52.2	≥$1948
Top 25%	630	75.7	≥$990	631	75.0	≥$842
Top 50%	1338	92.3	≥$415	1344	92.1	≥$345
Bottom 50%	1600	7.7	<$415	1594	7.9	<$345

TABLE 3 **Characteristics of Children in the Top Decile and Lower 90th Percentile for Costs in 2000 Compared With All Children**

Characteristic	Top Decile, % ($n = 249$)	Lower 90%, % ($n = 2689$)	P[a]	All Children, % ($n = 2938$)
Age, y				
<1	7	5	.33	5
1–5	16	29	<.001	27
6–10	19	29	.003	28
11–15	45	25	<.001	27
16–17	13	12	.66	12
CSHCN				
By ICD codes	33	14	<.001	16
By screener	35	13	<.001	15
Female gender	48	48	.94	48
Race/ethnicity				
Hispanic	9	18	<.001	17
Black, non-Hispanic	7	15	.001	15
White, non-Hispanic	83	62	<.001	65
Other	1	5	.003	4
Poverty status				
<100%	9	17	<.001	17
100% to <125%	5	6	.43	6
125% to <200%	16	16	.91	16
200% to <400%	30	34	.43	33
≥400%	40	27	.01	28
Insurance status				
Any private[b]	80	69	.004	70
Public only[c]	17	22	.18	21
Uninsured[d]	3	9	<.001	9
Any functional limitation	8	2	.001	3

[a] Statistical comparisons are made between the top decile and the lower 90th percentile.
[b] At least 1 month with private; other 11 months could be private, public, or uninsured.
[c] At least 1 month with public; other 11 months could be public or uninsured but not private.
[d] For all of 2000.

(3% vs 9%; $P < .001$) and more likely to have private insurance (80% vs 69%; $P = .004$).

Table 4 illustrates the change in percentiles from 2000 to 2001 for those in the various categories of costs: 48.7% of the children who had been in the top decile in 2000 remained in the top decile for costs in 2001, 69.9% of the children who had been in the top decile in 2000 remained in the top 25th percentile for 2001, and 12.5% dropped down into the bottom 50th percentile. At the same time, 2.1% of the children who had been in the bottom 50th percentile in 2000 moved up to the top decile in 2001.

TABLE 4 **Change in Costs From 2000 to 2001 for Children in Various Percentiles**

2000	% of Costs by Row, 2001			
	Top 10%	Top 25%	Top 50%	Bottom 50%
Top 10%	48.7	69.9	87.5	12.5
Top 25%	30.9	59.0	83.4	16.6
Top 50%	18.0	40.8	71.3	28.7
Bottom 50%	2.1	9.1	71.3	71.2

Percentages are by row. For example, 69.9% of individuals who had been in the top 10% in 2000 were in the top 25% in 2001.

Table 5 illustrates the results of the analysis using multivariate logistic regression to predict (on the basis of characteristics from 2000) which children would be in the top decile for 2001. For costs, the characteristics that were most predictive of being in the top decile for 2001 (and their odds ratios) included being in the top decile in 2000 (10.2), being 11 to 15 years of age (3.8), insurance status (public insurance: 3.0; private insurance: 2.7), being 16 to 17 years of age (2.4), having a special health care need (2.2), and having a functional limitation (1.9). The Hosmer-Lemeshow test statistic to assess the goodness of fit of the model was 0.54 (indicating a good fit). The pseudo-R^2 of the model was 0.150. For the sake of completeness, the same analysis was run for expenditures. The characteristics that were most predictive of being in the top decile for 2001 (and their odds ratios) included insurance status (private insurance: 10.4; public insurance: 8.4) having a special health care need (3.3), having a functional limitation (2.9), being in the top decile in 2000 (2.8), and being 16 to 17 years of age (2.7). The Hosmer-Lemeshow test statistic to assess the goodness of fit of the model was 0.01 (not a good fit). The pseudo-R^2 for the model was only 0.098.

TABLE 5 **Results of Logistic-Regression Analysis to Predict Being in the Top Decile for Costs for 2001**

Characteristic in 2000	Costs		
	OR	95% CI	P
In the top decile in 2000	10.16	7.37–14.00	<.001
Age, y			
<1	2.37	0.73–7.69	.15
1–5	1.02	0.52–1.99	.95
6–10	Referent		
11–15	3.75	2.11–6.66	<.001
16–17	2.38	1.27–4.48	.01
CSHCN screener			
Yes	2.15	1.45–3.19	<.001
Gender			
Female	1.26	0.94–1.69	.12
Male	Referent		
Race/ethnicity			
Hispanic	1.01	0.54–1.89	.97
Black, non-Hispanic	0.61	0.34–1.10	.10
White, non-Hispanic	Referent		
Other	0.89	0.28–2.89	.85
Poverty status			
<100%	Referent		
100% to <125%	1.06	0.44–2.54	.90
125% to <200%	1.98	1.11–3.53	.02
200% to <400%	1.55	0.81–2.99	.19
≥400%	1.78	0.89–3.54	.10
Insurance status			
Any private[a]	2.72	1.07–6.88	.04
Public only[b]	3.00	1.19–7.57	.02
Uninsured[c]	Referent		
Any functional limitation	1.92	1.02–3.61	.04

OR indicates odds ratio; CI, confidence interval.
[a] At least 1 month with private; other 11 months could be private, public, or uninsured.
[b] At least 1 month with public; other 11 months could be public or uninsured but not private.
[c] For all of 2000.

Table 6 illustrates a transition probability matrix for cost percentiles going from 2000 to 2001. This shows the probability of being in the various percentiles for 2001. A child who was in the top decile for costs in 2000 would have a probability of .49 of being in the top decile in the next year and a probability of .12 for being in the bottom half in 2001. Likewise, a child who was in the bottom half in 2000 would have a probability of .02 of being in the top decile in the next year.

DISCUSSION

Little is known about the persistence of health care costs in children. Determining whether children with high health expenses continue in a predictable way to have high expenses over time can help in the development of targeted programs to decrease costs, plan equitable health insurance strategies, and provide insights into the effects of costly conditions on families.

It is widely known that a relatively small proportion of children account for a large share of health care expenditures. In this study, we found that children who were in the top 10th percentile accounted for 70% of expenditures, a finding that is identical to the percentages reported by McCormick et al[1] and Ireys et al.[2] As would be expected, no single chronic condition dominated the list of diagnoses, and the reasons for receiving health care for children in the top decile included both acute and chronic conditions. These children had annual mean total expenditures of $6422 in 2000; by 2001, their mean total expenditures had fallen to $2463. This decrease likely reflects several factors, including regression to the mean, improved health for those who had an acute condition, and decreasing costs for infants as they age.[29,30] Because the use of expenditures does not reflect precisely the utilization of services, we developed a model to predict costs that are conditional on insurance status to try to predict more accurately true resource costs. Children in the top decile for 2000 accounted for 54% of all costs.

Using estimated costs, we found that 49% of the children who had been in the top decile remained there the next year. The factors in 2000 that predicted persistence of costs into the top decile in 2001 included being in the top decile for costs in the previous year, being 11 to 17 years of age, having a special health care need, having a functional limitation, and being insured. As hypothesized, CSHCN were more likely to be in the top percentiles[2,14] and to have persistent expenditures. This was true whether the CSHCN screener or ICD-9-CM codes were used. Also, as predicted, younger children were less likely to persist than older children. This reflects that whereas some expenses are predictable, others are random, or the factors that predict them have not yet been identified. In this study, neither race nor ethnicity predicted persistence, and children with private or public insurance had approximately the same risk for persisting in the top decile. These findings are inconsistent with the belief that black and Latino children who are on Medicaid account for a disproportionate share of costs or expenditures.

TABLE 6 **Transition Probability Matrix for Cost Percentiles Going From 2000 to 2001**

2000	2001			
	90%–100%	75%–89%	50%–75%	0%–50%
90%–100%	.49	.21	.18	.12
75%–89%	.19	.33	.29	.20
50%–75%	.05	.18	.36	.41
0%–50%	.02	.07	.20	.71

For example, a child in the top decile for costs in 2000 would have a probability of .49 of being in the top decile in the next year and a probability of .12 for being in the bottom half in 2001.

The model that used estimated costs led to better predictions than the model that used expenditures. In the cost model, 49% of the children who had been in the top decile remained there the next year, compared with 30% using expenditures. When logistic regression was used and other factors were controlled, the odds ratio for remaining in the top decile was 10 for those who had been in the top decile in 2000, compared with 2.76 for the model using expenditures. The measures of fit for the regression models were better when costs were used than when expenditures were used. When we used costs rather than expenditures, we found that a greater percentage of those in the top decile had a special health need (40% vs 33%). This may be a result of the greater proportion of children with Medicaid who were identified using costs rather than expenditures. A greater percentage of the poor (12% vs 9%) and those with public insurance (22% vs 17%) were in the top decile when costs were used; these findings make sense because the model that uses costs is less dependent on the actual flow of dollars (which would be less for those in poverty and/or with public insurance).

Limitations

This study has several limitations. First, some children will fall from the top decile in 1 year to a lower one simply because of the statistical phenomenon of regression to the mean,[31] and we have no way of quantifying this. Second, the MEPS publishes ICD-9-CM codes using only the first 3 digits, making categorization by specific diagnoses impossible. Third, the study does not address children who need care but do not receive it. Because such children do not pay for needed health care, their expenditures or costs would be 0. Fourth, the study was short term, only examining persistence from 2000 to 2001. Studies that evaluate longer term persistence would be useful. However, we are not aware of a data set for longer term follow-up at the national level that has reliable cost information.

Other limitations include that no measures of health-

related quality of life are available on the MEPS. For example, Seid et al[32] found that parental assessment of health-related quality of life plus chronic health condition status together led to a better prediction model of expenditures. They defined a high-risk group that constituted 8.7% of their sample and accounted for 37%, 59%, and 62% of health care expenditures at 6, 12, and 24 months, respectively. Furthermore, treatment patterns for similar conditions may exhibit significant geographic variation, which is not accounted for in this analysis.

We did not try to measure appropriate or discretionary costs or evaluate the quality of the care provided. These findings simply describe those in the top deciles for costs in the current system of care and do not address the equity or efficiency with which resources are used. Also, the methods for delivering care continually change. For instance, although there is a trend toward less inpatient hospital care, which reduces costs, this is counterbalanced by the increased use of high-technology interventions and more expensive medications that raise costs. In addition, no assessment of comorbidity or the seriousness of conditions was possible with the given data. Finally, expenditures reflect what insurance providers actually pay for care, and analyses of these are more salient for them in terms of payments. However, other studies already have evaluated expenditures; the goal of this study was to assess persistence of costs, and the estimated cost model provides much better prediction than does the use of expenditures.

Implications

Our study has several implications. One implication for clinicians is to review regularly the extent of care coordination that they are providing for their high-need and high-cost patients. A second is that patients with persistent high costs are likely to be preteens and adolescents; therefore, more attention to care coordination needs to be devoted to this age group. An implication for health care plans and Medicaid is that targeted programs to decrease expenditures for those in the top decile of costs have the potential to save a sizeable share of future pediatric health care costs. However, these need to be scrutinized extremely carefully to ensure that quality is not compromised. A second implication for health plans is to consider risk adjustment or other modalities to mitigate variations in costs and predict future costs better.

An implication for policy makers is that, contrary to what some may believe, low-income children and those who are on Medicaid do not cost disproportionately more than high-income children. Furthermore, persistence of high costs for the subset of low-income children is not greater than the persistence among high-income children. Because the types of health care services among the top 10% involved a variety of inpatient, ED, outpatient, and ancillary services, care coordination throughout the entire health care system is important to address both the cost and the quality aspects of health care for the most costly children. Clearly, there are children who require costly medical care; the methods described in this article seem to be effective in identifying these children. Programs that are designed to help patients navigate the system can optimize the care that is received for the price. These data should not be used to reduce resources that are available for children or somehow restrict access to services that are necessary and appropriate. Major reductions in programs such as Medicaid could affect adversely the health of these children and have significant implications for the public health and welfare systems as well as individual families.

CONCLUSIONS

Using costs provided a model that predicted future costs better than using expenditures. Half of the children in the top 10% for costs in 2000 persisted in the top 10% in 2001. Children who had been in the top decile in 2000, older children, those with some insurance, and those who had a special health care need or functional limitation were more likely to stay in the top decile for 2001. Targeted programs to decrease expenditures for those in the top decile of costs have the potential to save future health care costs.

Although expenditures for CSHCN can be extremely high, data from expenditures for adults place this spending into perspective. For example, using the MEPS for 2002, Conwell and Cohen[33] found that children and adolescents from birth to age 18 accounted for 37% of the bottom half of all expenditures for 2002 but only 5% of the top fifth percentile. Individuals aged 65 and older accounted for 43% of the top fifth percentile of the distribution but only 4% of the bottom half. Thus, the aggregate spending of children and teens pales in comparison with the spending of adults, especially the elderly.[34]

APPENDIX 1 **Mean Annual Expenditures in 2000 for Children by Cumulative Cohort in 2000**

	Sample Size	Total Expenditures in 2000, mean (SE)
Top 10%	249	$6422.19 ($1124.95)
Top 9%	220	$6911.04 ($1224.98)
Top 8%	195	$7492.65 ($1370.14)
Top 7%	171	$8224.38 ($1522.63)
Top 6%	144	$9153.76 ($1749.04)
Top 5%	121	$10 259.86 ($2022.40)
Top 4%	96	$11 969.36 ($2698.92)
Top 3%	73	$14 484.44 ($3538.29)
Top 2%	46	$18 942.23 ($4985.26)
Top 1%	24	$28 724.12 ($9059.00)

APPENDIX 2 Results of Regression Analysis to Predict Inpatient Costs

Independent Variables and Effects	β Coefficient	SE β
Intercept	−2839.75	864.08
Private insurance	6472.39	1970.38
Public insurance	3034.61	1051.64
No. of hospital nights (private)	−1171.00	437.22
No. of hospital nights (public)	−1314.43	404.78
Length of stay squared (private)	48.85	15.09
Length of stay squared (public)	58.05	16.27
Any operation (private)	−866.83	981.06
Any operation (public)	177.96	110.74
Any operation	1848.84	593.89
Length of stay squared	−58.86	14.83
No. of hospital nights	1816.89	330.83
Aged 3–5 y	660.80	719.02
Aged 6–12 y	981.72	961.09
Aged 13–17 y	−673.23	587.94
Male gender	21.54	553.71

APPENDIX 3 Results of Regression Analysis to Predict Outpatient Costs

Independent Variables and Effects	β Coefficient	SE β
Intercept	−10.05	29.29
Private insurance	20.58	16.03
Public insurance	13.07	6.08
Aged 3–5 y	8.46	6.59
Aged 6–12 y	11.81	3.79
Aged 13–17 y	68.07	43.76
Male gender	34.91	31.81

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Short-term Persistence of High Health Care Costs in a Nationally Representative Sample of Children

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