Title:
Healthcare utilization and spending among privately insured children with medical complexity

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Dr. Angela Wangari Walter conceptualized the study, conducted the literature review, supervised the data analysis and interpreted results, drafted the initial manuscript, revised the manuscript, and approved the final manuscript as submitted.
Dr. Randall P. Ellis conceptualized the analysis, reviewed and interpreted analysis, reviewed and revised the manuscript, and approved the final manuscript as submitted.
Ms. Yiyang Yuan performed the data analysis, revised the manuscript and approved the final manuscript as submitted.
All authors have critically reviewed the manuscript, approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

What's new
This study presents recent data from a high-quality commercial claims database on patterns of health service utilization, healthcare expenditures, and the magnitude of family financial burden for children with medical complexity who are enrolled in employer-sponsored health plans.

Abbreviations:
HMO - Health maintenance organization
PPO - Preferred provider organization

Key words: Children; Healthcare spending; Healthcare utilization; Medical complexity

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Abstract

Objectives: Children with medical complexity have high health service utilization and health expenditures that can impose significant financial burdens. This study examined these issues for families with children enrolled in U.S. private health plans.

Methods: Using IBM Watson/Truven Analytics℠ MarketScan® commercial claims and encounters data (2012-2014), we analyzed through regression models, the differences in healthcare utilization and spending of disaggregated healthcare services by health plan types and children's medical complexity levels.

Results: Children in consumer-driven and high-deductible plans had much higher out-of-pocket spending and cost shares than those in HMOs and PPOs. Children with complex chronic conditions had higher service utilization and out-of-pocket expenditures while having lower cost shares on various categories of services than those without any chronic conditions. Compared to families covered by PPOs, those with high-deductible or consumer-driven plans were 2.7 and 1.7 times more likely to spend over $1000 out-of-pocket on their children's medical care, respectively. Families with higher complexity levels were more likely to experience financial burdens from expenditures on children's medical services.

Conclusions: Policymakers and families with children need to be cognizant of the significant financial burdens that can arise from children's complex medical needs and health plan demand-side cost sharing.

Introduction

There has been tremendous interest in healthcare reforms to create incentives for cost-effective, high quality care, but little work has examined how families with children have been affected. Children with medical complexity, a subset of children with special healthcare needs (McPherson et al., 1998), refer to children with the most severe, complex, and life-threatening health problems (Berry et al., 2015; Cohen et al., 2012). Children with medical complexity have longer hospital stays (Gold et al., 2016) and more extensive needs for critical care resources (Chan et al., 2016), which leads to higher healthcare expenses (Berry et al., 2014; Cohen et al., 2012; McPherson et al., 1998). Increasing healthcare expenditures among children with medical complexity are growing in the U.S. and internationally. From 2005-2007, children with medical complexity made up about one-third of all pediatric healthcare spending across providers and healthcare settings in Ontario, Canada (Cohen et al., 2012).

Out-of-pocket expenses, defined as the share of healthcare costs incurred by the patient, have drastically grown in the U.S. as public and private health plans increase their deductibles, copayments, and coinsurance rates (Centers for Medicare and Medicaid Services, 2015). Growing out-of-pocket spending has important implications for patient access to care, health service utilization and health outcomes, particularly for families with children (Ellis et al., 2017b; Walter et al., 2017). Previous studies have shown that high out-of-pocket expenditures are associated with delayed and forgone healthcare services, nonadherence to prescription drugs, and poor health outcomes (Baughman et al., 2015; Wisk and Witt, 2012; Wiltshire et al., 2015; Oswald et al., 2007). Comprehensive healthcare delivery models for children with medical complexity are critical for coordinating healthcare and wrap-around services, and have the potential to reduce healthcare costs (Glassgow et al., 2017). While patient-centered medical homes are designed to deliver comprehensive, family centered and coordinated care, children with special healthcare needs with moderate to high severity are more likely to lack access to a medical home (Conrey et al., 2013).

As reliance on demand-side cost sharing is growing, both domestically and internationally including in China (Cao et al., 2012), Netherlands (van Winssen et al., 2016), and Singapore (Mossialos et al., 2016), so are concerns about the family financial burden of children with medical complexity. Families with one or more children with special healthcare needs are at increased risk of financial burdens (Shattuck and Parish, 2008; Parish et al., 2012; Chen and Newacheck, 2006; Ellis et al., 2017b). Kuo and colleagues estimated that nearly 50% of U.S. families with one or more children with special healthcare needs face financial burdens, including spending over $1,000 out-of-pocket on medical expenses (Kuo et al., 2011). Despite this, there has been little work on family financial burdens especially for families of medically complex children enrolled in private insurance plans, an important growing population (Newacheck et al., 2000). Privately insured children with medical complexity is of particular policy interest because private insurance often cannot provide adequate financial protection for families of children with special healthcare needs (Kogan et al., 2010; Kogan et al., 2005; Oswald et al., 2007), even with the assistance of health savings accounts or health reimbursement accounts.

Previous studies on healthcare utilization and costs for children with medical complexity have focused on Medicaid and Children's Health Insurance Plan enrollees who have traditionally low out-of-pocket costs (Cohen et al., 2012; Berry et al., 2014). This study contributes to the literature by assessing healthcare utilization and costs for children enrolled in private insurance plans in the U.S. Specifically, we analyzed healthcare utilization and spending of disaggregated

healthcare services, including hospitalization, emergency room services, mental health services, and prescription drugs, by health plan types and children's medical complexity levels. We also examined family financial burdens from expenditures on children's healthcare and how they varied across health plan types and family complexity levels. The study protocol was reviewed by the Institutional Review Board at Boston University Medical Center which determined that the study did not meet the definition of "human subject research".

Methods

Data

IBM Watson /Truven Analytics℠ MarketScan® commercial claims and encounters data 2012-2014 were used. These data contain annual medical and prescription drug claims for employees and their dependents covered by employer-sponsored health insurance (Hansen and Chang, 2011).

Study sample

Children aged 0 to 17 were included if at any time between 2012 to 2014 they: (1) had at least one medical encounter claim, and (2) were continuously enrolled for at least 12 months in one of the following four plan types: preferred provider organizations (PPOs), health maintenance organizations (HMOs), consumer-driven health plans or high-deductible health plans. The latter two types of plans, characterized by high deductibles, have been growing in popularity in recent years. These two plan types may or may not restrict consumers to a particular network of providers as do PPOs and HMOs but generally have lower premiums and offer a health reimbursement account or a health savings account to help employees better plan their healthcare expenditures.

Outcome variables

Healthcare service utilization: We analyzed children's annual utilization of the following services: inpatient hospitalization, emergency room services, mental health services, outpatient prescription drugs, durable medical equipments (DME), laboratory and radiologic testing services, and occupational/physical/speech therapies (OT/PT/ST). We chose to focus on these categories of services on the basis of the Children's Hospital Association's report on annual utilization of health services for Medicaid-enrolled children (Children's Hospital Association, 2011). Inpatient hospitalization was measured by the total number of hospital admissions in one year. Utilization of the remaining 6 cateogories of services, including emergency room and mental health services, was measured by the number of days in a year in which there was at least one visit for each corresponding service. Collapsing to count single day-episodes of service utilization was done because multiple claims often arise from a single patient visit in a given day for these services. Outpatient prescription drug utilization was calculated by the total number of times during one year that a prescription was filled, regardless of the type, duration or dosage of the drug.

Healthcare service expenditures: We calculated three expense measures at the family and individual child level: (1) annual total out-of-pocket spending, defined as the total expenses paid by the patient (sum of deductibles, coinsurance payments, and copayments) for a given type of healthcare service; (2) annual total cost, defined as the gross payment to a provider for a specific

type of service; and (3) cost share, defined as the percentage of total cost that was paid out-of-pocket by the patient. The distributions of annual total out-of-pocket spending and annual total cost were both highly skewed. We topcoded the extremely high values, corresponding to those in the top 0.1% percentile, in order to limit the effect of outliers (Youn et al., 2016; Ash and Ellis, 2012). Top-coding is a common procedure to deal with outliers in analyzing large datasets (Youn et al., 2016; Ash and Ellis, 2012; Pope et al., 2004; Minnesota Provider Peer Grouping (PPG), 2014; Ellis et al., 2017a). In our study sample, top-coding annual out-of-pocket spending at 99.9% level changed the mean out-of-pocket spending for various types of services, by only 0.9% to 2.1% (Supplemental Table A-i), and did not meaningfully change our regression results. Similarly, when annual out-of-pocket spending and total cost were both top-coded at 99.9%, the percent change in the mean cost shares were also minimal (Supplemental Table A–ii).

Family financial burden: A family was regarded as experiencing a financial burden if it had out-of-pocket expenditures over $1,000 on children's healthcare services in one year, consistent with previous research (Kogan et al., 2008; Kuo et al., 2011).

Covariates

Child-level covariates: Child-level medical complexity measure: The Pediatric Medical Complexity Algorithm, a modification of the Chronic Disability Payment System, was used to identify and stratify children aged 0-17 by levels of medical complexity (Simon et al., 2014). The algorithm assigns medical complexity levels to children according to progressiveness and malignancy of conditions while accounting for the number of body systems involved based on 3 consecutive years of medical claims data (Simon et al., 2014). We used a more conservative version of the algorithm to classify children into three medical complexity levels: "Complex chronic", if more than one body system was involved, or at least one condition was progressive or malignant; "Non-complex chronic", if only one body system was involved and the condition was neither progressive nor malignant; and "Non-chronic", if the child did not meet any of the other two criteria.

Other child-level covariates include children's age, gender, and types of health insurance.

Family-level covariates: Family-level medical complexity measure: Families were grouped into four categories according to the number of children with degrees of medical complexity: "No children with chronic condition", "One child with non-complex chronic condition", "One child with complex chronic condition", and "Two or more children with non-complex chronic and/or complex chronic conditions".

Statistical Analysis

We present descriptive statistics on children's age, gender, medical complexity levels in addition to family complexity measures, overall and by insurance plan types. Annual total health services use, total out-of-pocket expenditures, and cost shares by each category of health services were presented in means and standard deviations (SD) for the entire study sample, and by insurance plan types and by children's medical complexity levels.

In child-level analyses, we first used multiple negative binomial regression models to examine the differences in healthcare utilization between insurance plan types and medical complexity levels. Negative binomial regression models were particularly suited for cases in which potential overdispersion in the dependent variable (e.g., count data) needs to be accounted for (Hilbe, 2012). In terms of out-of-pocket expenditures, we analyzed dichotomized outcomes

of zero versus positive out-of-pocket expenditures, and used logistic regression models to assess the odds of positive out-of-pocket spending for each service by insurance plan types and medical complexity levels. Next, conditional on positive out-of-pocket spending (and thus positive cost shares), we log-transformed out-of-pocket spending and cost shares, and used multiple linear regression models to assess the differences in out-of-pocket expenditures and cost shares between plan types and medical complexity levels. In all these models, we controlled for children's age, gender and year of service. For family-level analysis, we used multiple logistic regression models to assess the association between family financial burden and family medical complexity levels.

We presented estimates from models along with 95% confidence intervals (95% CI). We evaluated statistical significance using P-value (* stands for P-value<0.001 and ** stands for P-value<0.0001). All analyses were conducted using SAS 9.4.

Results

Demographics

Demographics for the entire study sample and by health plan type are presented in Table 1. Over 7 million children (N=7,286,570) had at least one claim in any time from 2012 to 2014. Most children were enrolled in a PPO plan (73.2%), followed by HMOs (11.8%), consumer-driven plans (7.8%) and high-deductible plans (7.2%). The mean age was 7.5 (SD 5.2) and 50.8% were male. The distribution of age and gender of children was similar across plan types. Approximately 6.6% of the children had complex chronic conditions, 16.6% had non-complex conditions and 76.8% had non-chronic conditions. When stratified by plan types, 7.1% of the children enrolled in HMOs had complex chronic conditions, the highest proportion across all plan types. Children came from over 4 million families (N=4,389,281). The majority of the families had children with no chronic conditions (67.3%). Overall, 5.3% of the families in our sample had two or more children with complex chronic and/or non-complex chronic conditions, with the highest proportion seen in HMOs (5.9%) and the lowest in consumer-driven and high-deductible plans (4.3%).

---Insert Table 1---

Healthcare services utilization

As shown in Table 2, among children with at least one visit of each type of service, children on average had at least one inpatient hospitalization (1.1, SD (0.6)), at least one emergency room visit (1.4, SD (0.8)), 8.5 mental health visits, and 4.3 times that prescription drugs were filled per year. These rates were similar across plan types but varied meaningfully across medical complexity levels. Compared to children without complex chronic conditions, children with complex chronic conditions had more inpatient admissions (1.5, SD (1.4)), more emergency room visits (1.7, SD (1.3)), more mental health services visits (10.6, SD (18.8)), and more prescriptions filled (9.1, SD (9.6)) in a year. Children with complex chronic conditions had nearly twice as many visits as those without chronic conditions (10.6, SD (18.8) vs. 5.9, SD (7.5)), and thrice as many number of times that a prescription was filled (9.1, SD(0.6), vs. 3.0, SD (3.1)).

Using multiple negative binomial regression models, we assessed the impact of insurance plan types and children's medical complexity levels on healthcare services utilization adjusting

for children's age, gender and year of service. As shown in Table 3, estimated differences in the predicted number of uses between plan types were statistically significant for all services except for hospitalization, although the differences were in all cases less than six percent. Compared to children without any chronic conditions, children with non-complex chronic and complex chronic conditions had significantly higher utilization of all health services in a given year (Table 3). Specifically, compared to children without any chronic conditions, children with complex chronic conditions had 41.6% more hospital admissions, 30.3% more emergency room visits, nearly twice as many mental health service encounters, and almost three times as many prescription fills. The differences between children with non-complex chronic conditions and those without any chronic conditions were smaller but statistically signiticant. For example, children with non-complex chronic conditions received 51.2% more mental health services and twice as many prescription drug fills than those without any chronic conditions.

The utilization of other types of health services, i.e., durable medical equipment, laboratory and radiologic testing, and occupational/physical/speech therapies (OT/PT/ST) are shown in Supplemental Tables B (raw statistics) and C (regression adjusted statistics).

---Insert Table 2---
---Insert Table 3---

Out-of-pocket expenditures

Average out-of-pocket spending and cost shares are presented in Table 2. Overall, out-of-pocket spending on children averaged $914 (SD: 1,192), $369 (SD: 478), $276 (SD: 501), and $101 (SD: 223), respectively, on inpatient stays, emergency room visits, mental health services and prescription drugs (Table 2). In all of these types of services, out-of-pocket spending was the lowest for those enrolled in HMOs, and the highest for those enrolled in high-deductible health plans. When stratified by children's medical complexity levels, average out-of-pocket expenses for children with complex chronic conditions on hospitalization ($1,304, SD (1,558)) and on prescription drugs ($237, SD (396)) were approximately twice and four times as much, respectively, as children without chronic conditions.

Multiple logistic regression models were then used to examine the odds of making any versus zero annual out-of-pocket spending (Table 4a). Compared to children in PPO plans, those in HMO plans appeared to be significantly less likely to have any out-of-pocket spending on inpatient hospitalization (adjusted OR (aOR): 0.218, 95% CI: (0.214, 0.221)), emergency room services (aOR: 0.759, 95% CI: (0.748, 0.769)), and mental health services (aOR: 0.492, 95% CI: (0.485, 0.499)), and more likely to have positive out-of-pocket spending on prescription drugs (aOR: 1.162, 95% CI: (1.150, 1.175)) (Table 4a). In the case of children enrolled in consumer-driven and high-deductible health plans, respectively, they were 80.0% and 70.8% less likely to spend out-of-pocket on emergency room services, and 76.2% and 29.1% less likely to spend out-of-pocket on prescription drugs than those in PPO plans (Table 4a). Further, compared to those who had no chronic conditions, children with non-complex chronic conditions were 15.4% more likely to pay out-of-pocket for hospitalization and 63.1% more likely for prescription drugs, but 8.0% and 17.0% less likely to do so for emergency room and mental health services. Interestingly, children with complex chronic conditions were less likely to pay out-of-pocket for hospitalization (aOR: 0.872, 95% CI: (0.855, 0.889)) than those without any chronic conditions.

For those who had ever paid out-of-pocket, we examined differences in out-of-pocket expenses between private insurance plans and medical complexity levels using multiple

generalized linear models that control for children's age, gender and year of service (Table 4b). Compared to children in PPO plans, those in HMO plans had significantly lower out-of-pocket spending, and those in consumer-driven and high-deductible plans had significantly higher out-of-pocket spending for all four types of services. On the other hand, except for emergency rooms, out-of-pocket expenses from hosptializations, mental health services and prescription drugs were significantly higher in children with complex chronic conditions compared to those without any chronic conditions (Table 4b).

---Insert Tables 4a and 4b---

Cost shares

As shown in Table 2, average cost share for hospitalization was the lowest for those in HMOs (6.9%, SD (12.6%)), compared to around 17% in the other plan types. Average cost shares on emergency room, mental health services and prescription drugs were the highest for those enrolled in high-deductible plans, followed by consumer-driven plans, PPOs, and HMOs. Specifically for those in high-deductible plans, on average over 50% of total costs of emergency room services (52.8%, SD (42.8%)), mental health services (54.6%, SD (40.5%)), and prescription drugs (66.7%, SD (38.5)) were paid out-of-pocket by children's families. Children with complex conditions had the lowest cost shares for all four types of services (Table 2).

For all types of services, differences in cost shares between health insurance plans were similar to those in out-of-pocket spending in that HMO plans had significantly lower average cost shares that PPOs, while consumer-driven and high-deductible plans had significantly higher cost shares (Table 5). In contrast, cost shares in all service categories were significantly lower for sicker children (Table 5).

Out-of-pocket expenditures and cost shares for other types of services are shown in Supplemental Tables D-i, D-ii, and E. As expected, out-of-pocket expenses and cost shares on these service categories were the highest in high-deductible plans and the lowest in HMOs.

---Insert Table 5---

Family financial burden

Using $1,000 as the threshold for family financial burden, 8.4% of families exceeded this amount on their children's care in 2012. This percentage steadily increased over the years to 9.6% in 2013 and 10.4% in 2014 (Table 6). In terms of insurance plan types, only about 4% of families enrolled in HMOs had spent out-of-pocket costs over $1,000 on their children's medical care from 2012 to 2014, while approximately 14% of families in consumer-driven health plans and 17% of families in high-deductible health plans had to cope with a financial burden from children's healthcare expenditures of over $1,000 (Table 6).

The percentage of families that were impacted financially due to high expenditures on children's healthcare services increased as the number of medically complex children grew. Between 2012 and 2014, while less than 7% of families of no children with chronic conditions experienced financial burden, over 19% of families with two or more children with non-complex chronic and/or complex chronic conditions were in such a situation. Proportions of families that experienced such financial burden increased over the years, regardless of their complexity levels.

Next, we used multiple logistic regressions to examine the association between family financial burden and insurance plan types and family medical complexity levels, controlling for year of service. As indicated in Table 7, compared to families enrolled in PPOs, those enrolled in

HMO plans were significantly less likely (OR: 0.34, 95%CI: (0.33, 0.35)) to have spent annually over $1,000 out-of-pocket on their children's medical care services, while those in consumer-driven plans (OR: 1.69, 95%CI: (1.66, 1.72)) and high-deductible plans (OR: 2.70, 95%CI: (2.66, 2.74)) were significantly more likely to do so. In contrast to families without any complex children, families with any level of complexity were significantly more likely to experience financial burden. In particular, families with two or more children with complex chronic and/or non-complex chronic conditions were 3.63 (95%CI: (3.57, 3.69)) times as likely as those without any medically complex children to spend over $1,000 on children's medical care services.

---Insert Table 6---
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Discussion

Our findings demonstrate that privately insured children with complex chronic conditions had higher health service utilization and out-of-pocket expenditures than those without any chronic coniditions, particularly for inpatient hospitalization, mental health services and prescription drugs. While children with complex chronic conditions had the lowest cost shares, the projected rise in cost share over the next several years through higher deductibles, coinsurance or copayments (Centers for Medicare and Medicaid Services, 2015; Gaal et al., 2014; Thomas et al., 2014) can have a negative impact on access to care and health outcomes of children with medical complexities, resulting in higher overall costs of care.

This study contributes to the literature on family financial burdens experienced by privately insured families of children with medical complexity (Lindley and Mark, 2010; Kuo et al., 2011; Davidoff, 2004; Kuhlthau et al., 2005). We found that family financial burdens were experienced in more than 19% of the families with two or more children of complex chronic and/or non-complex chronic conditions, which persisted over the sample period. These findings are consistent with other research showing that families in high-deductible health plans of children with chronic conditions experienced considerable financial burdens (Galbraith et al., 2011). As new technologies continue to drive up healthcare costs, greater reliance on high deductibles and cost sharing would impose additional financial burdens on families of children with medical complexity. Although our paper focused on a sample from the U.S., the patterns of spending that we identifed will be helpful in understanding other countries where household financial burdens of families of children with special healthcare needs (a broader category than we study here) is a concern, such as in China (Xiong et al., 2011), the Netherlands (Hendriks et al., 2000), and Singapore (Tean, 2014).

Our findings show that families of children with medical complexity are 1.9 to 3.8 times as likely as those without chronically ill children to spend over $1,000 out-of-pocket per year on children's medical services. We note, however, that medical spending on children is not the only source of financial burdens for these families. Parents and/or family caregivers of children with medical complexity may have to reduce working hours or even quit jobs to take care of their children (Kogan et al., 2008; Kuhlthau et al., 2005; Kuo et al., 2011). Although we have only assessed the family financial burden from children's medical services, future studies could further investigate the magnitude of family burden in terms of parents and/or caregivers' financial, physical and mental health burdens. Moreover, future research is needed to evaluate how strategies such as case management and medical homes could be implemented to alleviate such family burdens.

Our extremely large sample allows us to separately evaluate impacts of four major health plans. Results show that the proportions of chronically complex children are similar across plan types. While healthcare utilization was similar across plan types, there were substantial differences in out-of-pocket expenditures, with children enrolled in high-deductible and consumer-driven plans having the highest out-of-pocket spending and greater probability of significant financial burden.

Over the past few years, high deductibles have been growing in popularity among private insurance plans provided by employers, with the objective of reducing healthcare expenses. Our study implies that insurance with high deductibles has not provided the needed financial protection for families with children of complex health needs. As healthcare marketplaces are expanded with greater high-deductible options, it is critical that information about health plan benefit design be provided in plain language to meet the literacy levels in the general population. In the special case for children, parents and/or caregivers need to understand not only the options available to their children but also the implications of health plan choice on out-of-pocket expenses.

Strengths and Limitations

There are several strengths of our study. First, we used a very large sample size (N=7.3 million) with recent data on healthcare utilization and spending of privately insured children, which enabled us to examine patters with more precision than previous studies using less than 100,000 children. We assessed children enrolled in PPOs, HMOs, consumer-driven and high-deductible health plans, which represented approximately 85% of all children in the database during the study period. While most studies on health services utilization and expenditures of children with medical complexity have focused on those enrolled in Medicaid or other public insurance programs, our findings contribute to the literature by focusing on children enrolled in employer-sponsored insurance programs, who makes up 48% of all U.S. children aged 0 to 18 (Kaiser Family Foundation, 2015). Moreover, we applied Pediatric Medical Complexity Algorithm, a publicly available algorithm, to identify children of different medical complexity levels, stratified by whether the conditions are chronic. This is the first study to have the power to compare rates of utilization across different plan types by specific types of services, including inpatient hospitalization, emergency room services, mental health services and outpatient prescription drugs. We implemented top-coding, a commonly-practiced procedure in large data analysis, to ameliorate the impact of outliers. We also conducted sensitivity analyses with respect to top-coding thresholds (99.5% and 99.0%) and showed that our findings were robust to these alternative thresholds (Supplemental Table F-i to F-iv).

A few limitations should be noted. First, the MarketScan data includes primarily very large employers and relatively well-insured enrollees, and hence may not be representative of all privately insured children and their families in the U.S. Second, we only studied those who remained in the same insurance plan types over the study period. Changes in plan types were not examined, which may result from high expenditures on certain services. Third, there could be meaningful differences across health plans within the same type, including plan premiums and whether enrollees have secondary coverage such as Medicaid. In addition, we were only able to control for age and gender in our models while other factors that are not available in our data may impact children's use of services including household income, race, education, and other sources of health insurance coverage. Furthermore, we only demonstrated association between family financial burden and insurance plan types and family complexity levels, without

implication for a causal relationship. Lastly, our findings may not be generalizable to other countires without similar health insurance and healthcare delivery structures.

Conclusion

This study adds to the limited literature on healthcare utilization and spending among privately insured children. Children with chronic medical conditions (particularly those with complex conditions) had significantly higher utilization and out-of-pocket spending on hospitalization, mental health services and prescription drugs than those without any chronic conditions. Their families were found to be at a much higher risk of experiencing financial burden due to expenses on their children's medical care.

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Supplemental Tables

Table 1. Characteristics of study sample, overall and by health plan type

	All	Health maintenance organizations	Preferred provider organizations	Consumer-driven health plans	High-deductible health plans
Children (#)	(N = 7,286,570)	(N=860,071)	(N=5,333,274)	(N=564,899)	(N=528,326)
Age[1] Mean (SD)	7.2 (5.2)	7.4 (5.2)	7.5 (5.2)	7.5 (5.3)	7.4 (5.2)
Female[1] (%)	49.2	49.3	49.2	49.3	49.3
Child complexity levels					
Non-chronic (%)	76.8	74.9	76.4	79.7	80.9
Non-complex chronic (%)	16.6	18.0	16.9	14.7	13.8
Complex chronic (%)	6.6	7.1	6.7	5.6	5.3
Number of families (#)	(N=4,389,281)	(N=521,916)	(N=3,218,288)	(N=340,130)	(N=308,947)
Family complexity levels					
No children with chronic condition (%)	67.3	65.0	66.8	71.1	72.3
One child with non-complex chronic condition (%)	19.9	21.1	20.1	18.0	17.2
One child with complex chronic condition (%)	7.5	8.0	7.7	6.5	6.2
Two or more children with complex chronic and/or non-complex chronic condition (%)	5.3	5.9	5.4	4.3	4.3

Notes:
[1] Age and gender were obtained from the first claim record observed in the claims database.

Table 2. Healthcare services utilization and expenditures on hospitalization, emergency room, mental health and prescription drug services

	Use[a] (#)		OOP[b] ($)		Cost share[c] (%)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Hospitalization (N = 629,531)						
All	1.1	(0.6)	914	(1192)	16.7	(19.1)
By insurance plan						
HMO	1.1	(0.7)	445	(854)	6.9	(12.6)
PPO	1.1	(0.6)	953	(1171)	17.4	(18.5)
Consumer-driven	1.1	(0.6)	1,036	(1278)	20.9	(22.9)
High-deductible	1.1	(0.8)	1,128	(1546)	19.6	(22.9)
By medical complexity level						
Non-chronic	1.0	(0.2)	732	(969)	19.0	(20.4)
Non-complex chronic	1.1	(0.5)	1,202	(1359)	15.0	(16.7)
Complex chronic	1.5	(1.4)	1,304	(1558)	9.6	(13.5)
Emergency room (N = 1,907,127)						
All	1.4	(0.8)	369	(478)	33.3	(32.1)
By insurance plan						
HMO	1.4	(0.8)	182	(258)	18.2	(21.2)
PPO	1.4	(0.9)	370	(450)	33.9	(30.8)
Consumer-driven	1.3	(0.8)	464	(602)	38.1	(38.2)
High-deductible	1.3	(0.8)	644	(748)	52.8	(42.8)
By medical complexity level						
Non-chronic	1.3	(0.7)	375	(477)	36.2	(33.3)
Non-complex chronic	1.4	(0.9)	366	(480)	30.2	(30.0)
Complex chronic	1.7	(1.3)	345	(480)	24.2	(26.6)
Mental health service (N = 717,116)						
All	8.5	(14.8)	276	(501)	33.8	(32.0)
By insurance plan						
HMO	8.9	(16.6)	156	(298)	19.2	(20.8)
PPO	8.4	(14.2)	283	(504)	34.3	(31.2)
Consumer-driven	8.2	(15.3)	294	(537)	38.4	(36.5)
High-deductible	8.8	(17.4)	432	(686)	54.6	(40.5)
By medical complexity level						
Non-chronic	5.9	(7.5)	218	(365)	38.3	(33.8)
Non-complex chronic	8.9	(15.4)	288	(516)	33.8	(31.9)
Complex chronic	10.6	(18.8)	316	(587)	28.8	(29.1)
Prescription drugs (N = 4,616,852)						
All	4.3	(5.3)	101	(223)	45.7	(34.6)
By insurance plan						
HMO	4.2	(5.1)	80	(164)	41.9	(32.1)
PPO	4.4	(5.3)	97	(209)	44.3	(33.6)
Consumer-driven	4.3	(5.2)	129	(292)	48.6	(39.0)
High-deductible	4.0	(5.1)	160	(350)	66.7	(38.5)
By medical complexity level						
Non-chronic	3.0	(3.1)	58	(132)	50.0	(35.5)
Non-complex chronic	6.5	(6.1)	177	(293)	37.1	(30.9)
Complex chronic	9.1	(9.6)	237	(396)	34.8	(29.9)

Notes:

N: number of children that had ever used a given service from 2012 to 2014.

[a] Use: annual total number of admissions (for hospitalization), number of visits to a given category of service (emergency room and mental health services), or number of days that prescription medications were filled.

[b] OOP: annual out-of-pocket spending in dollar amount on a given category of service. Negative out-of-pocket expenditures were excluded from the analysis, as were non-positive total costs. To avoid cost share over 100%, which may reflect adjustments or coverage caps, claims with out-of-pocket payment higher than total cost were also excluded.
[c] Cost share: annual percentage of total spending paid by the patient for a given category of service.

Table 3. Annual utilization of healthcare services (hospitalization, emergency room, mental health and prescription drug services)

	Hospitalization		Emergency room		Mental health service		Prescription drugs	
	Incidence rate ratio	95% CI	Incidence rate ratio	95% CI	Incidence rate ratio	95% CI	Incidence rate ratio	95% CI
Insurance plan								
PPO	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
HMO	1.001	(0.994, 1.009)	1.003	(1.000, 1.007)	1.056**	(1.054, 1.058)	0.933**	(0.932, 0.934)
Consumer-driven	0.998	(0.990, 1.006)	0.991**	(0.986, 0.995)	0.985**	(0.983, 0.988)	0.989**	(0.988, 0.990)
High-deductible	1.003	(0.994, 1.012)	0.974**	(0.970, 0.979)	1.052**	(1.049, 1.055)	0.935**	(0.934, 0.937)
Medical complexity level								
Non-chronic	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
Non-complex chronic	1.081**	(1.074, 1.088)	1.126**	(1.123, 1.129)	1.512**	(1.509, 1.515)	2.102**	(2.100, 2.103)
Complex chronic	1.416**	(1.407, 1.425)	1.303**	(1.299, 1.308)	1.808**	(1.804, 1.811)	2.950**	(2.947, 2.952)

Notes:
Multiple negative binomial models were used to examine the association between annual utilization of health services and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual service utilization was defined as: annual total admissions (for hospitalization), number of visits to a given category of service (emergency room and mental health services), or number of days that prescription medications were filled.
* P-value < 0.001
** P-value < 0.0001

Table 4a. Annual out-of-pocket expenditures on healthcare services (hospitalization, emergency room, mental health and prescription drug services): any vs. zero out-of-pocket spending

	Hospitalization		Emergency room		Mental health service		Prescription drugs	
	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Insurance plan								
PPO	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
HMO	0.218**	(0.214, 0.221)	0.759**	(0.748, 0.769)	0.492**	(0.485, 0.499)	1.162**	(1.150, 1.175)
Consumer-driven	1.162**	(1.132, 1.192)	0.200**	(0.197, 0.202)	0.580**	(0.568, 0.591)	0.238**	(0.236, 0.240)
High-deductible	0.981	(0.955, 1.008)	0.292**	(0.288, 0.297)	1.050*	(1.024, 1.077)	0.709**	(0.701, 0.718)
Medical complexity level								
Non-chronic	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
Non-complex chronic	1.154**	(1.131, 1.177)	0.920**	(0.910, 0.930)	0.830**	(0.819, 0.842)	1.631**	(1.617, 1.644)
Complex chronic	0.872**	(0.855, 0.889)	0.622**	(0.614, 0.630)	0.724**	(0.713, 0.736)	1.754**	(1.732, 1.777)

Notes:
Multiple logistic regression models were used to examine the odds of incurring any annual out-of-pocket spending vs. zero annual out-of-pocket spending with regards to insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service.
* P-value < 0.001
** P-value < 0.0001

Table 4b. Annual out-of-pocket expenditures on healthcare services (hospitalization, emergency room, mental health and prescription drug services): differences by insurance plans and by medical complexity levels for those who had above-zero out-of-pocket spending

	Hospitalization			Emergency room			Mental health service			Prescription drugs		
	Parameter estimate	95% CI		Parameter estimate	95% CI		Parameter estimate	95% CI		Parameter estimate	95% CI	
Insurance plan												
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.688**	(0.682,	0.695)	0.507**	(0.505,	0.509)	0.622**	(0.618,	0.626)	0.822**	(0.820,	0.824)
Consumer-driven	1.091**	(1.081,	1.102)	1.573**	(1.564,	1.582)	1.133**	(1.123,	1.143)	1.525**	(1.521,	1.529)
High-deductible	1.173**	(1.160,	1.185)	2.005**	(1.993,	2.017)	1.526**	(1.513,	1.540)	1.725**	(1.720,	1.730)
Medical complexity level												
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.360**	(1.350,	1.370)	1.005	(1.001,	1.008)	1.371**	(1.364,	1.378)	2.796**	(2.792,	2.801)
Complex chronic	1.550**	(1.538,	1.562)	0.996	(0.992,	1.001)	1.540**	(1.531,	1.549)	3.787**	(3.777,	3.796)

Notes:
Multiple generalized linear models were used to examine the association between annual out-of-pocket spending (top-coded at 99.9%) and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Log transformation was used on the out-of-pocket payment. Only those who had made positive out-of-pocket payments were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Table 5. Cost shares on healthcare services (hospitalization, emergency room, mental health and prescription drug services): differences by insurance plans and by medical complexity levels for those who had above-zero cost shares

	Hospitalization		Emergency room		Mental health service		Prescription drugs	
	Parameter estimate	95% CI	Parameter estimate	95% CI	Parameter estimate	95% CI	Parameter estimate	95% CI
Insurance plan								
PPO	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
HMO	0.635**	(0.629, 0.641)	0.552**	(0.550, 0.555)	0.635**	(0.631, 0.639)	0.946**	(0.944, 0.948)
Consumer-driven	1.151**	(1.140, 1.162)	1.411**	(1.403, 1.419)	1.213**	(1.202, 1.223)	1.248**	(1.244, 1.251)
High-deductible	1.126**	(1.114, 1.138)	1.781**	(1.770, 1.791)	1.568**	(1.554, 1.582)	1.527**	(1.523, 1.532)
Medical complexity level								
Non-chronic	(REFERENCE)		(REFERENCE)		(REFERENCE)		(REFERENCE)	
Non-complex chronic	0.813**	(0.807, 0.820)	0.868**	(0.866, 0.871)	0.909**	(0.905, 0.914)	0.739**	(0.738, 0.740)
Complex chronic	0.546**	(0.542, 0.551)	0.732**	(0.729, 0.735)	0.800**	(0.795, 0.805)	0.695**	(0.694, 0.697)

Notes:
Multiple generalized linear models were used to examine the association between annual cost share of a given category of service and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual cost share of a given category of service was defined as the percentage of total cost that was paid out-of-pocket by the patient. Claims with non-positive cost and cost lower than out-of-pocket payments were removed. Total cost and out-of-pocket payment were top-coded at 99.9%. Log transformation was used on the annual cost shares. Only those who had positive cost shares were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Table 6. Percentage of families that had financial burden (total out-of-pocket expenses over $1,000 on children's medical services) in one year, by plan types and family complexity levels

	Year 2012	Year 2013	Year 2014
	%	%	%
All	8.4	9.6	10.4
Insurance plan			
HMO	3.4	4.1	4.0
PPO	8.1	9.4	10.3
Consumer-driven	13.8	14.4	13.7
High-deductible	16.6	17.0	16.8
Family complexity levels			
No children with chronic condition	4.9	5.8	6.7
One child with non-complex chronic condition	9.6	11.5	13.8
One child with complex chronic condition	15.8	18.4	20.4
Two or more children with complex chronic and/or non-complex chronic condition	19.0	21.5	23.7

Table 7. Predictors for family financial burden (total out-of-pocket expenses over $1,000 on children's medical services) in one year

	Adjusted odds ratio	95% Wald confidence interval
Insurance plan		
PPO		(REFERENCE)
HMO	0.34**	(0.33, 0.35)
Consumer-driven	1.69**	(1.66, 1.72)
High-deductible	2.70**	(2.66, 2.74)
Family complexity levels		
No children with chronic condition (%)		(REFERENCE)
One child with non-complex chronic condition (%)	1.94**	(1.91, 1.97)
One child with complex chronic condition (%)	3.82**	(3.77, 3.88)
Two or more children with complex chronic and/or non-complex chronic condition (%)	3.63**	(3.57, 3.69)

Notes:
* P-value < 0.001
** P-value < 0.0001
Multiple logistic regression model was adjusted for year of service.

Supplemental Table A-i. Percent change in mean annual out-of-pocket payment with top-coding at different thresholds, by service category

Service	**Mean:** *Original* [a]	**Mean:** *Remove negative* [b]	**% change** [*]	**Mean:** *Remove negative + Top-coding at 99.9%* [c]	**% change** [*]	**Mean:** *Remove negative + Top-coding at 99.5%* [d]	**% change** [*]	**Mean:** *Remove negative + Top-coding at 99.0%* [e]	**% change** [*]
Inpatient services	923.58	925.79	0.11	913.64	-1.08	904.58	-2.06	896.60	-2.92
DME services	94.88	98.83	1.10	96.89	2.12	93.07	-1.91	88.59	-6.63
Lab services/Radiology services	59.77	60.07	1.68	59.24	-0.89	56.92	-4.77	54.63	-8.60
OT, PT, ST services	330.64	337.57	0.31	335.82	1.57	330.52	-0.04	324.98	-1.71
ER	373.15	370.03	0.27	369.15	-1.07	366.08	-1.89	362.63	-2.82
Mental health services (except above	272.91	278.23	0.37	275.82	1.07	269.98	-1.07	264.21	-3.19
Prescription drugs	102.84	102.80	0.97	101.34	-1.46	98.31	-4.40	95.37	-7.26

Note:

[a] Mean of annual out-of-pocket payment

[b] Updated mean of annual out-of-pocket payment, with negative out-of-pocket payments removed

[c] Updated mean of annual out-of-pocket payment, with negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.9%

[d] Updated mean of annual out-of-pocket payment, with negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.5%

[e] Updated mean of annual out-of-pocket payment, with negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.0%

[*] % percent change = (updated mean – original mean) /original mean * 100%

Supplemental Table A-ii. Percent change in mean cost share with top-coding of annual out-of-pocket payment and total cost at different thresholds, by service category

Service	**Mean:** *Original* [a]	**Mean:** *Remove negative* [b]	**% change** *	**Mean:** *Remove negative + Top-coding at 99.9%* [c]	**% change** *	**Mean:** *Remove negative + Top-coding at 99.5%* [d]	**% change** *	**Mean:** *Remove negative + Top-coding at 99.0%* [e]	**% change** *
Inpatient services	N/A	36.00	N/A	35.99	0.00	35.95	-0.14	35.87	-0.36
DME services		26.65		26.64	0.00	26.53	-0.45	26.45	-0.75
Lab services/Radiology services		35.97		35.97	0.00	35.93	-0.11	35.89	-0.22
OT, PT, ST services		33.30		33.29	0.00	33.26	-0.12	33.21	-0.27
ER		33.81		33.80	0.00	33.77	-0.12	33.74	-0.21
Mental health services (except above		45.70		45.69	0.00	45.65	-0.11	45.61	-0.20
Prescription drugs		16.63		16.62	0.00	16.60	-0.18	16.58	-0.30

Note:
Annual cost share of a given category of service was defined as the percentage of total cost that was paid out-of-pocket by the patient. Data with non-positive cost and where cost lower than out-of-pocket payments were removed.

[a] Original cost shares were not calculated as there were negative total cost and/or out of-pocket payment in the dataset.

[b] Mean of annual cost share, calculated with negative out-of-pocket payments and negative and zero total cost removed.

[c] Updated mean of annual cost share, calculated with negative out-of-pocket payments and negative and zero total cost removed, negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.9%

[d] Updated mean of annual cost share, calculated with negative out-of-pocket payments and negative and zero total cost removed, negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.5%

[e] Updated mean of annual cost share, calculated with negative out-of-pocket payments and negative and zero total cost removed, negative out-of-pocket payments removed and annual out-of-pocket payment top-coded at 99.0%

* % percent change = (updated mean – mean with negative removed) /updated mean with negatives removed * 100%

Supplemental Table B. Healthcare services utilization and expenditures on durable medical equipment, laboratory and radiologic testing and occupational/physical/speech therapies

	Use (#)		OOP ($)		Cost share (%)	
	Mean	**(SD)**	**Mean**	**(SD)**	**Mean**	**(SD)**
Durable medical equipment (N = 314,025)						
All	2.0	(3.4)	97	(286)	36.0	(41.5)
By insurance plan						
HMO	2.1	(3.6)	45	(210)	15.1	(29.1)
PPO	2.0	(3.4)	102	(282)	38.7	(42.0)
Consumer-driven	2.0	(3.4)	110	(328)	37.4	(41.5)
High-deductible	2.0	(3.4)	142	(406)	48.5	(44.0)
By medical complexity level						
Non-chronic	1.4	(1.5)	59	(154)	41.7	(43.7)
Non-complex chronic	1.7	(2.1)	103	(291)	36.6	(41.4)
Complex chronic	3.6	(6.1)	165	(434)	23.6	(33.8)
Laboratory and radiologic testing (N = 5,446,864)						
All	2.2	(2.1)	59	(166)	32.0	(39.8)
By insurance plan						
HMO	2.1	(2.0)	23	(102)	10.4	(25.4)
PPO	2.2	(2.1)	61	(163)	33.5	(39.8)
Consumer-driven	2.1	(2.0)	69	(193)	36.3	(41.1)
High-deductible	2.1	(2.0)	94	(238)	51.8	(43.8)
By medical complexity level						
Non-chronic	1.9	(1.4)	45	(129)	33.1	(41.0)
Non-complex chronic	2.4	(2.0)	73	(185)	30.9	(38.1)
Complex chronic	3.6	(4.1)	129	(283)	27.0	(34.2)
Occupational/physical/speech therapies (N = 652,432)						
All	10.7	(15.8)	336	(587)	36.0	(34.0)
By insurance plan						
HMO	9.8	(14.3)	211	(398)	23.5	(25.8)
PPO	10.8	(15.9)	338	(582)	36.2	(33.5)
Consumer-driven	10.7	(16.0)	360	(618)	38.0	(36.6)
High-deductible	10.7	(17.0)	475	(782)	50.5	(40.8)
By medical complexity level						
Non-chronic	7.2	(9.1)	240	(407)	39.9	(36.2)
Non-complex chronic	11.7	(16.3)	373	(616)	35.4	(32.9)
Complex chronic	16.2	(22.3)	472	(777)	29.2	(29.7)

Notes:

N: number of children that had ever used a given service from 2012 to 2014.

[a] Use: annual total number of times that durable medical equipment was prescribed, or total number of times that a testing was prescribed, or total number of visits to occupational/physical/speech therapies.

[b] OOP: annual out-of-pocket spending in dollar amount on a given category of service. Negative out-of-pocket expenditures were excluded from the analysis, as were non-positive total costs. To avoid cost share over 100%, which may reflect adjustments or coverage caps, claims with out-of-pocket payment higher than total cost were also excluded.

[c] Cost share: annual percentage of total spending paid by the patient for a given category of service.

Supplemental Table C. Annual utilization of healthcare services (durable medical equipment, laboratory and radiologic testing and occupational/physical/speech therapies)

	Durable medical equipment		Laboratory and radiologic testing		Occupational/physical/speech therapies	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Insurance plan						
PPO	(REFERENCE)		(REFERENCE)		(REFERENCE)	
HMO	1.001	(0.994, 1.009)	1.056**	(1.054, 1.058)	0.933**	(0.932, 0.934)
Consumer-driven	0.998	(0.990, 1.006)	0.985**	(0.983, 0.988)	0.989**	(0.988, 0.990)
High-deductible	1.003	(0.994, 1.012)	1.052**	(1.049, 1.055)	0.935**	(0.934, 0.937)
Medical complexity level						
Non-chronic	(REFERENCE)		(REFERENCE)		(REFERENCE)	
Non-complex chronic	1.081**	(1.074, 1.088)	1.512**	(1.509, 1.515)	2.102**	(2.100, 2.103)
Complex chronic	1.416**	(1.407, 1.425)	1.808**	(1.804, 1.811)	2.950**	(2.947, 2.952)

Notes:
Multiple negative binomial models were used to examine the association between annual utilization of health services and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual service utilization was defined as total number of times (in days) each given category of service was used.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table D-i. Annual out-of-pocket expenditures on healthcare services (durable medical equipment, laboratory and radiologic testing and occupational/physical/speech therapies): any vs. zero out-of-pocket spending

	Durable medical equipment		Laboratory and radiologic testing		Occupational/physical/speech therapies	
	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Insurance plan						
PPO	(REFERENCE)		(REFERENCE)		(REFERENCE)	
HMO	0.238**	(0.233, 0.243)	0.220**	(0.219, 0.221)	0.510**	(0.502, 0.518)
Consumer-driven	0.906**	(0.880, 0.933)	1.139**	(1.133, 1.145)	0.808**	(0.791, 0.826)
High-deductible	1.540**	(1.485, 1.597)	2.057**	(2.045, 2.070)	1.155**	(1.126, 1.184)
Medical complexity level						
Non-chronic	(REFERENCE)		(REFERENCE)		(REFERENCE)	
Non-complex chronic	1.013	(0.995, 1.030)	1.264**	(1.260, 1.268)	1.083**	(1.069, 1.098)
Complex chronic	0.761**	(0.747, 0.775)	1.588**	(1.581, 1.596)	0.903**	(0.890, 0.916)

Notes:
Multiple logistic regression models were used to examine the odds of incurring any annual out-of-pocket spending vs. zero annual out-of-pocket spending with regards to insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table D-ii. Annual out-of-pocket expenditures on healthcare services (durable medical equipment, laboratory and radiologic testing and occupational/physical/speech therapies): differences by insurance plans and by medical complexity levels for those who had above-zero out-of-pocket spending

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.803**	(0.791,	0.816)	0.891**	(0.888,	0.895)	0.715**	(0.709,	0.720)
Consumer-driven	1.089**	(1.071,	1.106)	1.077**	(1.074,	1.081)	1.139**	(1.129,	1.150)
High-deductible	1.248**	(1.228,	1.269)	1.241**	(1.237,	1.245)	1.398**	(1.385,	1.411)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.826**	(1.809,	1.844)	1.403**	(1.400,	1.406)	1.404**	(1.396,	1.411)
Complex chronic	3.340**	(3.304,	3.377)	2.348**	(2.341,	2.354)	1.752**	(1.741,	1.762)

Notes:
Multiple generalized linear models were used to examine the association between annual out-of-pocket spending (top-coded at 99.9%) and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Log transformation was used on the out-of-pocket payment. Only those who had made positive out-of-pocket payments were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table E. Cost shares on healthcare services (durable medical equipment, laboratory and radiologic testing and occupational/physical/speech therapies): differences by insurance plans and by medical complexity levels for those who had above-zero cost shares

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.761**	(0.749,	0.773)	0.752**	(0.749,	0.755)	0.750**	(0.744,	0.756)
Consumer-driven	0.977**	(0.962,	0.993)	1.029**	(1.026,	1.033)	1.077**	(1.067,	1.087)
High-deductible	1.112**	(1.094,	1.131)	1.219**	(1.215,	1.223)	1.353**	(1.341,	1.365)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	0.898**	(0.889,	0.906)	0.855**	(0.854,	0.857)	0.884**	(0.880,	0.889)
Complex chronic	0.649**	(0.642,	0.656)	0.691**	(0.689,	0.693)	0.756**	(0.752,	0.760)

Notes:
Multiple generalized linear models were used to examine the association between annual cost share of a given category of service and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual cost share of a given category of service was defined as the percentage of total cost that was paid out-of-pocket by the patient. Claims with non-positive cost and cost lower than out-of-pocket payments were removed. Total cost and out-of-pocket payment were top-coded at 99.9%. Log transformation was used on the annual cost shares. Only those who had positive cost shares were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table F-i-iv. Multiple regression models on out-of-pocket expenditures and cost shares with top-coding at 99.5% and 99.0% thresholds

Supplemental Table F-i. Annual out-of-pocket expenditures on healthcare services (Top-coding at 99.5%)

	Hospitalization			Emergency room			Mental health service			Prescription drugs		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan												
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.690**	(0.683,	0.697)	0.510**	(0.508,	0.512)	0.630**	(0.626,	0.634)	0.829**	(0.828,	0.831)
Consumer-driven	1.091**	(1.081,	1.101)	1.568**	(1.559,	1.577)	1.129**	(1.119,	1.138)	1.499**	(1.495,	1.503)
High-deductible	1.163**	(1.151,	1.175)	1.979**	(1.967,	1.990)	1.509**	(1.496,	1.522)	1.669**	(1.664,	1.674)
Medical complexity level												
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.354**	(1.344,	1.364)	1.004	(1.001,	1.007)	1.350**	(1.343,	1.357)	2.766**	(2.761,	2.770)
Complex chronic	1.529**	(1.518,	1.541)	0.995	(0.991,	0.999)	1.502**	(1.493,	1.511)	3.628**	(3.620,	3.637)

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	1.259**	(0.782,	0.807)	0.894**	(0.891,	0.897)	0.719**	(0.713,	0.725)
Consumer-driven	1.080**	(1.062,	1.097)	1.058**	(1.055,	1.061)	1.140**	(1.130,	1.151)
High-deductible	1.206**	(1.186,	1.226)	1.195**	(1.192,	1.199)	1.386**	(1.374,	1.399)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.792**	(1.775,	1.809)	1.381**	(1.379,	1.384)	1.394**	(1.387,	1.401)
Complex chronic	3.170**	(3.136,	3.205)	2.226**	(2.220,	2.232)	1.719**	(1.709,	1.730)

Notes:

Multiple generalized linear models were used to examine the association between annual out-of-pocket spending (top-coded at 99.5%) and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Log transformation was used on the out-of-pocket payment. Only those who had made positive out-of-pocket payments were included in the analyses.

* P-value < 0.001

** P-value < 0.0001

Supplemental Table F-ii. Cost shares on healthcare services (Top-coding at 99.5%)

	Hospitalization			Emergency room			Mental health service			Prescription drugs		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan												
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.635**	(0.683,	0.697)	0.553**	(0.550,	0.555)	0.636**	(0.632,	0.640)	0.946**	(0.945,	0.948)
Consumer-driven	1.151**	(1.081,	1.101)	1.410**	(1.402,	1.418)	1.213**	(1.203,	1.224)	1.246**	(1.242,	1.249)
High-deductible	1.123**	(1.151,	1.175)	1.775**	(1.764,	1.785)	1.567**	(1.553,	1.581)	1.522**	(1.518,	1.527)
Medical complexity level												
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	0.813**	(1.344,	1.364)	0.868**	(0.866,	0.871)	0.909**	(0.904,	0.914)	0.738**	(0.736,	0.739)
Complex chronic	0.545**	(1.518,	1.541)	0.732**	(0.729,	0.735)	0.800**	(0.795,	0.804)	0.696**	(0.694,	0.697)

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.761**	(0.749,	0.773)	0.752**	(0.749,	0.755)	0.751**	(0.745,	0.757)
Consumer-driven	0.977	(0.961,	0.993)	1.028**	(1.024,	1.031)	1.077**	(1.068,	1.087)
High-deductible	1.109**	(1.091,	1.128)	1.215**	(1.211,	1.218)	1.352**	(1.340,	1.364)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	0.896**	(0.888,	0.905)	0.854**	(0.853,	0.856)	0.884**	(0.879,	0.889)
Complex chronic	0.647**	(0.640,	0.654)	0.691**	(0.689,	0.692)	0.755**	(0.750,	0.759)

Notes:
Multiple generalized linear models were used to examine the association between annual cost share of a given category of service and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual cost share of a given category of service was defined as the percentage of total cost that was paid out-of-pocket by the patient. Claims with non-positive cost and cost lower than out-of-pocket payments were removed. Total cost and out-of-pocket payment were top-coded at 99.5%. Log transformation was used on the annual cost shares. Only those who had positive cost shares were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table F-iii. Annual out-of-pocket expenditures on healthcare services (Top-coding at 99.0%)

	Hospitalization			Emergency room			Mental health service			Prescription drugs		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan												
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.691**	(0.684,	0.698)	0.512**	(0.510,	0.514)	0.638**	(0.634,	0.643)	0.835**	(0.834,	0.837)
Consumer-driven	1.089**	(1.079,	1.099)	1.559**	(1.551,	1.568)	1.127**	(1.117,	1.136)	1.474**	(1.470,	1.478)
High-deductible	1.153**	(1.141,	1.165)	1.948**	(1.937,	1.960)	1.493**	(1.480,	1.506)	1.624**	(1.619,	1.628)
Medical complexity level												
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.350**	(1.340,	1.360)	1.004	(1.000,	1.007)	1.332**	(1.326,	1.339)	2.722**	(2.717,	2.726)
Complex chronic	1.516**	(1.504,	1.527)	0.993	(0.989,	0.998)	1.472**	(1.463,	1.480)	3.488**	(3.480,	3.496)

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.790**	(0.777,	0.802)	0.893**	(0.890,	0.897)	0.724**	(0.719,	0.730)
Consumer-driven	1.057**	(1.040,	1.074)	1.039**	(1.036,	1.042)	1.140**	(1.130,	1.151)
High-deductible	1.146**	(1.127,	1.166)	1.163**	(1.160,	1.167)	1.374**	(1.361,	1.386)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	1.746**	(1.730,	1.763)	1.363**	(1.360,	1.366)	1.383**	(1.376,	1.391)
Complex chronic	3.013**	(2.980,	3.046)	2.130**	(2.124,	2.135)	1.691**	(1.681,	1.701)

Notes:
Multiple generalized linear models were used to examine the association between annual out-of-pocket spending (top-coded at 99.0%) and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Log transformation was used on the out-of-pocket payment. Only those who had made out-of-pocket payments were included in the analyses.
* P-value < 0.001
** P-value < 0.0001

Supplemental Table F-iv. Cost shares on healthcare services (Top-coding at 99.0%)

	Hospitalization			Emergency room			Mental health service			Prescription drugs		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan												
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.635**	(0.629,	0.642)	0.553**	(0.551,	0.555)	0.637**	(0.633,	0.641)	0.947**	(0.945,	0.949)
Consumer-driven	1.151**	(1.140,	1.162)	1.408**	(1.400,	1.416)	1.213**	(1.203,	1.224)	1.243**	(1.239,	1.246)
High-deductible	1.120**	(1.108,	1.132)	1.766**	(1.756,	1.776)	1.565**	(1.551,	1.578)	1.516**	(1.512,	1.520)
Medical complexity level												
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	0.813**	(0.807,	0.819)	0.868**	(0.866,	0.871)	0.909**	(0.905,	0.914)	0.736**	(0.735,	0.737)
Complex chronic	0.545**	(0.540,	0.549)	0.733**	(0.729,	0.736)	0.800**	(0.795,	0.805)	0.696**	(0.694,	0.698)

	Durable medical equipment			Laboratory and radiologic testing			Occupational/physical/speech therapies		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Insurance plan									
PPO	(REFERENCE)			(REFERENCE)			(REFERENCE)		
HMO	0.761**	(0.749,	0.773)	0.752**	(0.749,	0.755)	0.752**	(0.746,	0.758)
Consumer-driven	0.975	(0.959,	0.990)	1.026**	(1.022,	1.029)	1.078**	(1.068,	1.087)
High-deductible	1.103**	(1.085,	1.122)	1.210**	(1.206,	1.214)	1.350**	(1.337,	1.362)
Medical complexity level									
Non-chronic	(REFERENCE)			(REFERENCE)			(REFERENCE)		
Non-complex chronic	0.894**	(0.886,	0.903)	0.853**	(0.851,	0.855)	0.883**	(0.878,	0.888)
Complex chronic	0.646**	(0.639,	0.653)	0.690**	(0.688,	0.691)	0.754**	(0.749,	0.758)

Notes:
Multiple generalized linear models were used to examine the association between annual cost share of a given category of service and insurance plan types and medical complexity levels, adjusting for children's age, gender, and year of service. Annual cost share of a given category of service was defined as the percentage of total cost that was paid out-of-pocket by the patient. Claims with non-positive cost and cost lower than out-of-pocket payments were removed. Total cost and out-of-pocket payment were top-coded at 99.0%. Log transformation was used on the annual cost shares. Only those who had positive cost shares were included in the analyses.
* P-value < 0.001
** P-value < 0.0001