# Care Quality and Spending Among Commercially Insured Children With Disabilities

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## ABSTRACT

***OBJECTIVE:*** To identify opportunities to improve care value for children with disabilities (CWD), we examined CWD prevalence within a commercially insured population and compared outpatient care quality and annual health plan spending levels for CWD relative to children with complex medical conditions without disabilities; children with chronic conditions that are not complex; and children without disabling, complex, or chronic conditions.

***METHODS:*** This cross-sectional study comprised 1,118,081 person-years of Blue Cross Blue Shield Massachusetts data for beneficiaries aged 1 to 19 years old during 2008 to 2012. We combined the newly developed and validated Children with Disabilities Algorithm with the Pediatric Medical Complexity Algorithm to identify CWD and non-CWD subgroups. We used 14 validated or National Quality Forum–endorsed measures to assess outpatient care quality and paid claims to examine annual plan spending levels and components.

***RESULTS:*** CWD constituted 4.5% of all enrollees. Care quality for CWD was between 11% and 59% for 8 of 14 quality measures and >80% for the 6 remaining measures and was generally comparable to that for non-CWD subgroups. Annual plan spending among CWD was a median and mean 23% and 53% higher than that for children with complex medical conditions without disabilities, respectively; CWD mean and median values were higher than for all other groups as well.

***CONCLUSIONS:*** CWD were prevalent in our commercially insured population. CWD experienced suboptimal levels of care, but those levels were comparable to non-CWD groups. Improving the care value for CWD involves a deeper understanding of what higher spending delivers and additional aspects of care quality.

**KEYWORDS:** children with disabilities; quality; spending

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## WHAT'S NEW

Commercially insured children with disabilities have greater health care spending than their nondisabled counterparts. Children with disabilities receive recommended elements of outpatient care at similar levels to children without disabilities, although both groups frequently experience suboptimal care quality.

CHILDREN WITH DISABILITIES (CWD) are a distinct subpopulation of children who have long-term functional impairments that stem from a wide range of clinical diagnoses.[1,2] Diagnoses yield impairments (developmental, psychological, physical, sensory, and intellectual) and impairments interact with the environment to limit children's ability to learn, communicate, move, and care for themselves.[1–3]

CWD are different from other subpopulations of children in the degree to which their lives are impeded by a medical condition. A heterogeneous array of diagnoses can connote the likelihood of a disabling condition. For example, autism, alexia, and Down syndrome can signify substantially altered developmental or intellectual trajectories; congenital quadriplegia, chronic respiratory failure, schizophrenia, and bilateral hearing loss indicate physical, psychological, and sensory impairments that are likely to be disabling despite available treatments. From a population perspective, CWD tend to be different from children with complex medical conditions (eg, type 1 diabetes); children with chronic conditions that are not complex (eg, asthma); and children without disabling, complex, or chronic conditions (eg, children who mainly experience self-limited acute illnesses such as streptoccocal pharyngitis or upper respiratory tract infections).[3] Survey and Medicaid-based claims studies find the prevalence of CWD in the United States to be between 5% and 8%.[4–6]

CWD, similar to all children, need appropriate preventive, acute, and chronic disease care in the outpatient setting.[7,8] CWD may need health care that specifically addresses the disabling effects of their condition (eg, speech and language therapy for autism, mobility enhancements for paraplegia). CWD may also be in particular need of high-quality health care unrelated to the disabling effects of their condition, as relatively minor health issues can have a differentially large impact (eg, an upper respiratory infection in a child with low lung function reserves can lead to respiratory distress requiring inpatient support).[7] As a result, how CWD use health care may reflect spending patterns and levels that are distinct from non-CWD subgroups.[9] Greater insight into how CWD fare from care quality and spending perspectives may help inform how to shape value-based incentives or programs of care.

Our current understanding of care quality for CWD is limited to survey-based or single-site examinations involving specific clinical subsets of CWD or adults with disabilities; these studies suggest that the quality of care being delivered to CWD likely needs improving.[10–13] Our study of care quality for Medicaid-insured CWD corroborated survey-based and site-based studies. Medicaid-insured CWD received recommended care at rates <50% on 8 of 12 primarily outpatient care measures.[6] Prior studies of spending on CWD have been impeded by difficulty identifying this subpopulation in datasets spanning all care settings (eg, inpatient, outpatient, and pharmacy), and a lack of information on actual prices paid for services (relying instead on list prices or "charges").[14] The newly developed and validated Children With Disabilities Algorithm (CWDA) can help identify populations of children with at least a 75% chance of being CWD using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes.[3] However, we need a better understanding of the prevalence of CWD in a commercially insured population. Commercial health plans insure at least half of children with special health care needs in the United States, so it is likely that commercial insurers are an important understudied payer for CWD.[9,15]

Additionally, as payment policy continues to shift from incentivizing volume (ie, fee-for-service) to value (eg, accountable care contracts, bundled payments), stakeholders (health plans and increasingly providers who are taking on financial risk for populations) need to improve their understanding of CWD care quality within the context of CWD care spending.[16–19] CWD spending may be comparable to that of children with complex medical conditions that are not disabling, but it could also be higher (eg, owing to more health care need and effort) or lower (eg, if therapies are being delivered through alternative settings, such as the education system).[9,20,21]

Thus the aims of this study were to describe, in a commercially insured population, the 1) prevalence of CWD, 2) quality of outpatient care for CWD and non-CWD based on validated or endorsed outpatient care quality measures, and 3) spending levels and patterns among CWD relative to non-CWD subgroups.

## METHODS

### STUDY DESIGN AND DATA SOURCE

We conducted a cross-sectional study of the enrollees insured by Blue Cross Blue Shield of Massachusetts (BCBSMA) and 1 to 19 years of age within any year during a 5-year period spanning 2008 to 2012 (the most currently available dates at the time the study was started). BCBSMA is the health plan with the largest market share in Massachusetts (57%).[22] We conducted a person-level analysis and treated each year within the 5-year period as part of a single 5-year cross section in time because we wanted to maximize the number of times we could observe CWD and assess annual care quality; a prior analysis also demonstrated that spending patterns did not change significantly across the study period, suggesting that the study year would not have a significant or substantial impact on overarching findings.[23,24] To illustrate, a child may not be a CWD in 2008 but could be in 2012—we would want to understand care quality for that CWD in 2012. Additionally, a child may be a CWD across the 5-year period of time but transition from childhood to adolescence during that time—the person-year analysis would allow us to understand care quality for the CWD in 2 measure domains. Our data files included claims and corresponding diagnostic and procedure codes for all outpatient, inpatient, and pharmacy services paid for by BCBSMA during that period of time; data were ≥92% complete on necessary variables. The Boston Children's Hospital Institutional Review Board approved this study.

### STUDY POPULATION

Our study population was 1,118,081 person-years among children 1 to 19 years of age with at least 1 full calendar year of BCBSMA insurance anytime during the study period. We included enrollees who had full pharmacy and mental health benefits and lived in New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont); we excluded

person-years for those with <12 months of enrollment because they lacked the full year of data needed to assess care quality and annual health plan spending.

### IDENTIFICATION OF CWD AND NON-CWD SUBGROUPS

To identify CWD and non-CWD subpopulations of children, we combined 2 existing algorithms for identifying subgroups of children using diagnostic codes—CWDA and the Pediatric Medical Complexity Algorithm. We categorized children according to condition severity within each calendar year.

CWDA is grounded in the United Nations' and World Health Organization's definition of disability and in the International Classification of Functioning.[1,2] CWDA was developed by 8 research-trained pediatric experts on CWD with input from 42 pediatric subspecialists who cross-walked individual *International Classification of Diseases, Ninth Revision* codes to their likelihood of corresponding to a >75% chance of disability. CWDA was also triangulated against both parent and physician report of disabilities.[3] A single CWDA-qualifying code was associated with 0.78 sensitivity relative to parent report and 0.98 sensitivity relative to physician chart abstraction. Additional detail about CWDA beyond that already published is available on request.[3] The aim of the Pediatric Medical Complexity Algorithm was to separate children with complex medical conditions (eg, "significant chronic conditions in ≥2 body systems" or "progressive condition that is associated with deteriorating health with a decreased life expectancy in adulthood") from children with noncomplex chronic conditions without particular attention to the degree to which those conditions were likely to be associated with functional ability or activity limitations.[14]

Combining CWDA and the Pediatric Medical Complexity Algorithm allowed us to divide our study population into 4 mutually exclusive and hierarchical subpopulations ranging from children with the greatest likelihood of functional impairment and substantial activity limitation to least: CWD; children with nondisabling complex medical conditions (eg, cystic fibrosis); children with noncomplex chronic conditions (eg, asthma, attention-deficit/hyperactivity disorder [ADHD]); and children without disabling, complex, or chronic conditions.[3,25] If children had diagnostic codes that corresponded to more than 1 subgroup, they were classified according to the most severely affected group (eg, a child with profound bilateral hearing loss, cystic fibrosis, and ADHD would be considered a CWD because bilateral hearing loss is a CWDA-qualifying code).

### OUTCOMES OF INTEREST

#### *CWD PREVALENCE*

The algorithm categorized children as CWD if they had at least 1 CWDA-qualifying code within the calendar year of interest.[3] We determined CWD prevalence by dividing the total person-year count of CWD by the total person-years of eligible enrollees 1 to 19 years of age; we identified the percentage of enrollees within each non-CWD subgroup with the same approach.

#### *OUTPATIENT CARE QUALITY PERFORMANCE AND COMPARABILITY*

To assess pediatric outpatient care quality, we used claims-based pediatric measures that have been considered valid by pediatricians participating in a Delphi process and subsequently endorsed by the National Quality Forum or comparable accrediting organizations.[17] We first followed Healthcare Effectiveness Data and Information Set specifications for these measures, which span preventive/screening services (4 measures), acute conditions (2 measures), and chronic disease (8 measures), and oriented all measures so that lower values indicate lower levels of care quality (Appendix A).[23] Typically, Healthcare Effectiveness Data and Information Set uses claims-based information to define a population with the clinical problem of interest (eg, need for a well child visit, diagnosis code for streptococcal pharyngitis) and uses additional claims-based information (eg, specific age group or procedure code for a streptococcal pharyngitis test) to capture whether individuals within the defined age range or who are experiencing a particular health problem receive a certain element of care. We then stratified quality measure performance by underlying condition subpopulation: CWD; children with complex medical conditions; children with chronic conditions; and children without disabling, complex, or chronic conditions. Percentages reflect the eligible enrollees within each subgroup with the defined clinical problem who have received the quality element.

#### *SPENDING LEVELS AND PATTERNS*

For all spending calculations, we used paid claims because they reflect the actual dollars that the health plan paid providers on behalf of individual patients.

We used previously established methods for calculating total annual spending (ie, added up all payments made by plans across a year).[24] To calculate the percentage of total annual spending due to outpatient (eg, primary care and specialty office visits), pharmacy, emergency department, or inpatient services, we used outpatient, inpatient, and pharmacy file designations within our dataset to attribute claims to the corresponding service. We then applied Current Procedural Terminology codes to identify emergency department services within the outpatient claims file.[26,27,28]

We provide both median and mean levels of spending because value-based interventions are likely to be different for patients spending at the 50th percentile (ie, that for half the population of CWD) versus patients at the high and low spending tails within each subgroup. This allows stakeholders to consider the financial impact of strategies that may increase value for a majority of patients (eg, a small change across a large volume of patients) versus strategies that may change value for patients at very high or low levels of spending (eg, a larger change for a small volume of patients). We adjusted all dollar values to 2010 dollars using the Consumer Price Index for all urban

consumers.[29] We excluded annual patient out-of-pocket spending (with a median and mean of ~$174 and ~$257, respectively), administrative costs, and additional payments that the plan may have made to providers via bonuses or shared savings and delivered at an aggregate rather than individual level.[30–32]

### STATISTICAL ANALYSIS

We used descriptive statistics to provide frequencies and distributions for characteristics of interest, quality performance measures, and levels of spending across the 5-year time period.

To examine the significance of differences in quality measure performance levels across CWD and non-CWD subgroups, we used chi-square tests because the quality measures are dichotomous in nature. As the quality measures were typically considered process measures, we did not further risk adjust quality measures beyond stratifying them by our 4 levels of clinical severity.[23]

To evaluate the significance of differences in spending outcomes (total annual payments, utilization, prices) between CWD and non-CWD subgroups, we used 2-sided Welch *t* tests with unequal variances because a prior study already demonstrated that spending was a log-normally distributed variable in this dataset; subgroup spending was also normally distributed.[24] As a sensitivity analysis for the analysis related to spending, we also used a generalized estimating equation to examine the significance of spending differences by CWD and non-CWD subgroups while adjusting for age, sex, geocoded area–based socioeconomic background,[23,32,33] health plan type, and basic benefit design.

## RESULTS

In this commercially insured population, CWD constituted 4.5% of all enrollees (n = 49,944); 6.1% of our study population was identified as children with complex medical conditions; 19.5%, as children with chronic conditions, and the remaining 70%, as children without disabling, complex, or chronic conditions (Table 1). If CWD had been retained within the same category as children with complex medical conditions, they would have comprised 43% of the children in the complex medical conditions category.

### CWD OUTPATIENT CARE QUALITY

CWD received recommended care 11% to 59% of the time for 8 of 14 recommended care measures and >80% of the time for 6 of 14 measures (Table 2). Performance levels were <60% for adolescent chlamydia screening (24%), lead screening (59%), both measures for ADHD (48% after initial visit, 49% subsequently), alcohol or marijuana treatment initiation (48% alcohol, 47% marijuana), and alcohol/

**Table 1.** Study Population for Each Person-Year of Enrollment in Blue Cross Blue Shield of Massachusetts, 2008 to 2012

| Characteristic | n (%) |
|---|---|
| Person-years | 1,118,081 (100)* |
| Age | |
| 1–5 y | 251,637 (23) |
| 6–12 y | 410,793 (37) |
| 13–19 y | 455,651 (41) |
| Male sex | 571,106 (51) |
| Clinical subgroups (mutually exclusive) | |
| CWD | 49,944 (4.5) |
| Children with nondisabling complex medical conditions | 67,635 (6.1) |
| Children with noncomplex chronic conditions | 217,672 (19.5) |
| Children without disabling, complex, or chronic conditions | 782,830 (70.0) |
| Geocoded socioeconomic background† | |
| High (≥1 SD above enrollee mean) | 173,235 (16) |
| Medium | 803,170 (72) |
| Low (≤1 SD below enrollee mean) | 141,676 (13) |
| Health plan type‡ | |
| Employer-sponsored | 761,298 (68) |
| Self-insured | 356,783 (32) |
| Basic benefit design§ | |
| Health maintenance organization | 821,353 (73) |
| Preferred provider organization | 238,559 (21) |
| Point of service | 58,169 (5) |

CWD indicates children with disabilities.

*This corresponds to 429,282 unique enrollees.

†Based on the validated area-based socioeconomic measure.[23,32,33]

‡Employer-sponsored means the employer purchases health insurance from a health plan on behalf of its employees and the insurer takes the financial risk. Self-insured means that the employer designs and funds its own health plan for its employees. The employer takes the financial risk and may pay a health plan fee to administer the health plan (eg, process claims).

§Health maintenance organization and point of service benefit designs typically require enrollees to designate a primary care provider (PCP) who directs care within a designated network for which there are no or limited patient out-of-pocket costs; out-of-pocket costs rise if patients seek out-of-network care. In health maintenance organizations, patients must involve their PCPs in directing care to a greater degree than in point of service plans. In preferred provider organization plans, PCPs are not required to direct care, and enrollees typically pay some out-of-pocket amounts for the care they seek.

**Table 2.** Performance on Outpatient Quality Measures for Different Groups of Children with Commercial Insurance

| | | Mutually Exclusive Categories | | | |
|---|---|---|---|---|---|
| | Total Person-Years Qualifying for Each Performance Measure | CWD | Children with Nondisabling Complex Medical Conditions | Children with Noncomplex Chronic Conditions | Children Without Chronic, Complex, or Disabling Conditions |
| Performance measure | n | % | % | % | % |
| Prevention/screening | | | | | |
| Well visits child | 212,507 | 93 | 93 | 93 | 91*** |
| Well visits adolescent | 452,668 | 81 | 85*** | 83*** | 76*** |
| Chlamydia screening | 64,091 | 24 | 24 | 26 | 25 |
| Lead screening | 48,597 | 59 | 59 | 59 | 56** |
| Acute care | | | | | |
| Streptococcal pharyngitis testing | 52,523 | 87 | 85** | 87 | 87 |
| Upper respiratory infection treatment | 53,407 | 94 | 92** | 93 | 94 |
| Asthma† | | | | | |
| Asthma controller medication | 17,740 | 96 | 96 | 96 | NA |
| No emergency department visits | 17,740 | 93 | 92 | 92 | NA |
| ADHD† | | | | | |
| Treatment initiation | 10,677 | 48 | 46 | 35*** | NA |
| Treatment engagement | 3588 | 49 | 49 | 34*** | NA |
| Alcohol/drug dependence‡ | | | | | |
| Treatment initiation alcohol | 1940 | 48 | 33** | 24*** | NA |
| Treatment engagement alcohol | 1940 | 11 | 9 | 8 | NA |
| Treatment initiation marijuana | 2722 | 47 | 38* | 31*** | NA |
| Treatment engagement marijuana | 2722 | 13 | 12 | 11 | NA |

CWD indicates children with disabilities; ADHD, attention-deficit/hyperactivity disorder; and NA, not applicable.

*$P < .05$.

**$P < .01$.

***$P < .001$.

†Diagnoses of asthma and ADHD qualify children as having a chronic condition, so it is not possible to measure care quality among children with none-of-the-above conditions. Children with complex or disabling conditions have additional diagnoses that qualify them for those respective categories.

‡Children with alcohol/drug dependence can be considered CWD if the dependence involves use of opioids, amphetamines, or hallucinogens. Children with these disabling drug dependence conditions were excluded from this measure.

marijuana treatment engagement (11% alcohol, 13% marijuana). Performance levels were highest for child well visits (93%), adolescent well visits (81%), streptococcal pharyngitis testing (87%), upper respiratory infection treatment (94%), and both asthma measures (96% for asthma controller medication, 93% for no emergency department visits).

### CWD Versus Non-CWD Outpatient Care Quality

In general, the quality of care delivered to CWD was comparable to non-CWD subgroups, and this was true for measures with low performance levels (eg, chlamydia screening performance range across all 4 groups was 24% to 26%) and high performance levels (eg, child well visits performance range across all 4 groups was 91% to 93%) (Table 2). The main exceptions to this pattern were in the measures related to the treatment of behavioral health conditions (ADHD and alcohol/drug dependence care) in which quality levels for CWD were 10% to 24% greater than those for non-CWD.

### CWD Versus Non-CWD Total Annual Spending

Spending levels among CWD were significantly higher than among all non-CWD subgroups from both median and mean perspectives (Table 3). CWD total annual spending had a median and mean of $3883 and $11,704 (SD $43,138), whereas total annual spending among children with complex medical conditions had a median and mean of $3147 and $7632 (SD $18,784). The total annual spending levels for children with chronic conditions had a median and mean of $1575 and $2985 (SD $5448), and total annual spending levels for children without disabling, complex, or chronic conditions had a median and mean of $509 and $1020 (SD $2095). From the median perspective, total annual spending among CWD was 1.2, 2.5, and 7.6 greater than for children with complex medical conditions; children with chronic conditions; and children without disabling, complex, or chronic conditions. Correspondingly, mean total annual spending among CWD was 1.5, 3.9, and 11.5 times greater than for children with complex medical conditions; children with chronic conditions; and children without disabling, complex, or chronic conditions. Our sensitivity analysis using linear regression to examine the significance of spending differences by CWD and non-CWD subgroups while adjusting for age, sex, geocoded area–based socioeconomic background,[24,33,34] health plan type, and basic benefit design also confirmed these findings (Appendix B).

### CWD Component Spending

Outpatient services represented the largest component of total annual spending among CWD compared with all

**Table 3.** Health Care Spending for Different Groups of Children with Commercial Insurance

| Service Type | CWD (n = 49,944 person-years) | | Children with Nondisabling Complex Medical Conditions (n = 67,635 person-years) | | Children with Noncomplex Chronic Conditions (n = 217,672 person-years) | | Children Without Disabling, Complex, or Chronic Conditions (n = 782,830 person-years) | |
|---|---|---|---|---|---|---|---|---|
| | Median | Mean (SD) | Median | Mean (SD) | Median | Mean (SD) | Median | Mean (SD) |
| Total | $3883 | $11,704 ($43,138) | $3147 | $7632 ($18,784) | $1575 | $2985 ($5448) | $509 | $1020 ($2095) |
| Outpatient | $3134 | $7122 ($28,870) | $2383 | $4826 ($10,889) | $1144 | $2110 ($3366) | $454 | $848 ($1432) |
| Inpatient | $0 | $3374 ($25,521) | $0 | $1592 ($11,492) | $0 | $328 ($3194) | $0 | $65 ($1167) |
| ED | $0 | $104 ($350) | $0 | $102 ($291) (NS) | $0 | $54 ($165) | $0 | $26 ($100) |
| Pharmacy | $80 | $1105 ($4083) | $198 | $1112 ($5345) (NS) | $105 | $493 ($1551) | $0 | $82 ($478) |

CWD indicates children with disabilities; ED, emergency department.
All comparisons between CWD and non-CWD groups are significant for $P < .001$ except for those marked as nonsignificant (NS).

components of spending (inpatient, outpatient, pharmacy, and emergency department) from both median and mean spending perspectives (Table 3, Figure). Outpatient services comprised 98% of median total annual spending for CWD (left side of Figure) and 61% of mean total annual spending for CWD (right side of Figure).

After outpatient spending, the next most prevalent form of spending depended on whether one took the median or the mean perspective. From a median perspective, the second largest component of spending was pharmacy services. From a mean perspective, the second largest component of spending was on inpatient services; proportions of spending on inpatient services were monotonically smaller for children with complex medical conditions and children with chronic conditions.

## Discussion

To our knowledge, this study is the first to investigate the prevalence of CWD within a commercially insured population and to describe corresponding care quality levels, total annual spending patterns, and differences in care quality and spending that may exist between CWD and non-CWD. Our identification of 4.5% of commercially insured children as CWD is slightly lower but comparable to our finding that 5.3% of Medicaid-insured children were CWD and quite close to survey-based prevalence estimates.[4–6]

Our finding that outpatient care quality for commercially insured CWD is <60% on 8 of 14 measures supports the notion that recommended elements of care need improving for CWD. The fact that care quality is relatively comparable between CWD and non-CWD groups when they are commercially insured suggests that a more general approach to improving care quality in a commercially insured population may reach CWD and non-CWD groups similarly. Our findings in a Medicaid-insured population illustrated more dissimilarity in performance between CWD and non-CWD groups (some higher and some lower), which suggests that quality improvement efforts for Medicaid-insured patients may require more targeted interventions.[6] Generally greater contact with the health care system may explain why treatment initiation for alcohol use, marijuana use, and ADHD were higher for CWD versus non-CWD groups.

Our spending findings are important in that they highlight the degree to which outpatient care contributes to total annual spending for CWD and non-CWD; prior studies have generally been able to focus on the inpatient aspects of care and spending. Those interested in engaging in value-based contracts, where reducing annual spending levels tends to be a key component, would benefit from understanding that, from the health plan perspective, spending is substantially higher among CWD versus non-CWD subgroups; CWD could be another subpopulation for focus.[35,36] Because outpatient services dominated total annual spending for CWD, future efforts may be needed to better understand how outpatient visits can be targeted, configured, or incentivized to improve

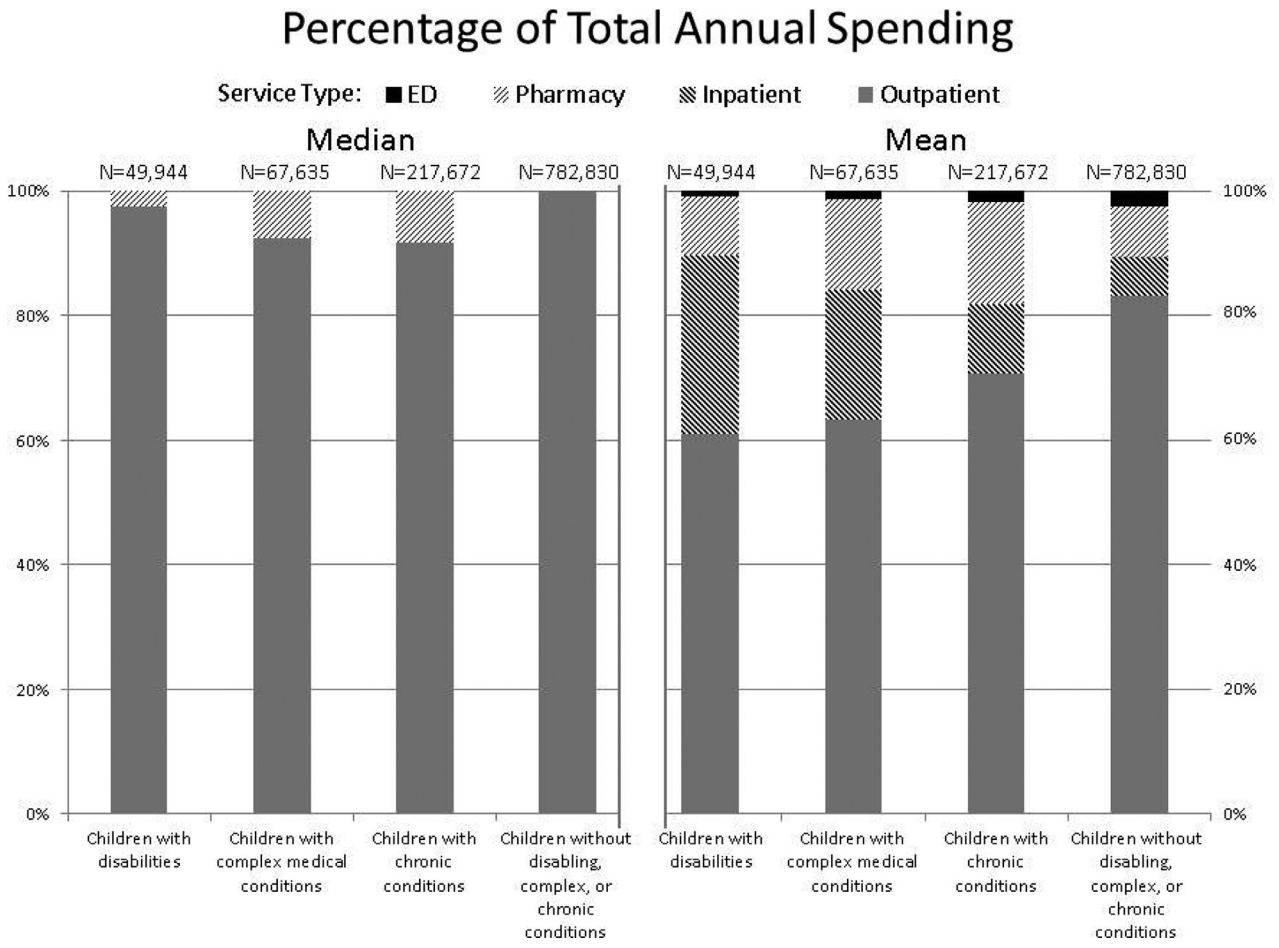


**Figure.** *Median/mean components of spending by CWD and non-CWD sub-groups.*

the value of care delivered for CWD or for non-CWD subgroups.

Our main limitation is that we studied a single health insurance plan in Massachusetts, although it is the health plan with the largest market share in that state (57%),[22] and claims data are highly reliable for analyzing spending from the health plan perspective (especially when paid prices are available); there is also a high degree of correlation among commercial health plans with respect to spending.[37] Another limitation is that although we used a large number of validated or endorsed outpatient pediatric quality measures, these recommended elements of outpatient care do not address all the outpatient care quality aspects that may be important to children generally or to CWD specifically.[38–40] Furthermore, this study focused on the population of enrollees who were continuously enrolled for a year (this is a requirement for available quality measures and a convention for those assessing annual spending), so findings are likely to differ if one studies those with less than a year of insurance. Last, even though survey estimates find that commercial payers insure about half of CWD, one tenth of CWD may have a secondary Medicaid payer, and that spending is not captured by our study.[9,15] However, the lack of Medicaid data for those with secondary insurance biases our study against us finding the differences that we did—were we able to include Medicaid data, it is likely that quality and spending differences for CWD would be even greater. The prominence of outpatient spending could also be even greater, given that Medicaid often covers outpatient services (eg, physical or occupational therapy) that private insurers do not.

Previously, our understanding of care quality for CWD had to be extrapolated from studies focused on children with a particular diagnosis (eg, sensory impairment, autism) or based in a single institution.[10,11] Studies that could provide more of a population view were limited to children with special health care needs who may have chronic but not necessarily disabling conditions (eg, psoriasis)[16,41] or were investigations of quality of care for adults with disabilities.[12,13] Studies based in large claims datasets allow us to understand CWD care quality and spending at the population level across all the providers who may be caring for CWD.

## CONCLUSIONS

Before this study, an understanding of the prevalence of CWD within a commercially insured population as well as information on care quality and spending for CWD generally and relative to their non-CWD peers was not available. This study shows that CWD are as prevalent within a

commercially insured population as they are within the general or Medicaid-insured populations.[4–6] Our findings demonstrate that care quality is relatively comparable for commercially insured CWD and non-CWD; this finding stands in contrast to that for Medicaid-insured CWD who experience care that is less frequently comparable to non-CWD. Taken together, this study supports the idea that available claims-based pediatric metrics may provide insight into different types of patterns of care quality for CWD. Last, as payment models continue to shift from volume to value, it shows how much attention may need to be paid to outpatient dimensions of care for all subpopulations of children, but for CWD especially.

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## REFERENCES

1. United Nations. Convention on the rights of persons with disabilities and optional protocol. Available at: http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf. Accessed September 22, 2015.
2. World Health Organization. *International Classification of Functioning, Disability and Health: ICF*. Geneva, Switzerland: World Health Organization; 2001.
3. Chien AT, Kuhlthau KA, Toomey SL, et al. Development of the children with disabilities algorithm. *Pediatrics*. 2015;136:e871–e878.
4. Houtrow AJ, Larson K, Olson LM, et al. Changing trends of childhood disability, 2001-2011. *Pediatrics*. 2014;134:530–538.
5. Halfon N, Houtrow A, Larson K, et al. The changing landscape of disability in childhood. *Future Child*. 2012;22:13–42.
6. Chien AT, Kuhlthau KA, Toomey SL, et al. Quality of primary care for children with disabilities enrolled in Medicaid. *Acad Pediatr*. 2017;17:443−449.
7. Canfield RL, Henderson CR, Cory-Slechta DA, et al. Intellectual impairment in children with blood lead concentrations below 10 microg per deciliter. *N Engl J Med*. 2003;348:1517–1526.
8. American Academy of Pediatrics Committee on Practice and Ambulatory Medicine, Bright Futures Periodicity Schedule Workgroup. 2016 Recommendations for Preventive Pediatric Health Care. *Pediatrics*. 2016;137:1–3.
9. Houtrow AJ, Okumura MJ, Hilton JF, et al. Profiling health and health-related services for children with special health care needs with and without disabilities. *Acad Pediatr*. 2011;11:508–516.
10. Megargel E, Broder-Fingert S. Autism and hospitals: a difficult match. *Acad Pediatr*. 2012;12:469–470.
11. Boss EF, Niparko JK, Gaskin DJ, et al. Socioeconomic disparities for hearing-impaired children in the United States. *Laryngoscope*. 2011;121:860–866.
12. Iezzoni LI, McCarthy EP, Davis RB, et al. Mobility impairments and use of screening and preventive services. *Am J Public Health*. 2000;90:955–961.
13. Chan L, Doctor JN, MacLehose RF, et al. Do Medicare patients with disabilities receive preventive services? A population-based study. *Arch Phys Med Rehabil*. 1999;80:642–646.
14. Sinaiko AD, Chien AT, Rosenthal MB. The role of states in improving price transparency in health care. *JAMA Intern Med*. 2015;175:886–887.
15. Musumeci M. Medicaid and children with special health care needs. Available at: http://files.kff.org/attachment/Issue-Brief-Medicaid-and-Children-with-Special-Health-Care-Needs. Accessed February 8, 2017.
16. Chien AT, Song Z, Chernew ME, et al. Two-year impact of the alternative quality contract on pediatric health care quality and spending. *Pediatrics*. 2014;133:96–104.
17. Chien AT, Li Z, Rosenthal MB. Improving timely childhood immunizations through pay for performance in Medicaid-managed care. *Health Serv Res*. 2010;45(6 Pt 2):1934–1947.
18. Chien AT, Colman MW, Ross LF. Qualitative insights into how pediatric pay-for-performance programs are being designed. *Acad Pediatr*. 2009;9:185–191.
19. Chien AT, Conti RM, Pollack HA. A pediatric-focused review of the performance incentive literature. *Curr Opin Pediatr*. 2007;19:719–725.
20. Kuhlthau K, Perrin JM, Ettner SL, et al. High-expenditure children with Supplemental Security Income. *Pediatrics*. 1998;102(3 pt 1):610–615.
21. Perrin JM, Kuhlthau K, McLaughlin TJ, et al. Changing patterns of conditions among children receiving Supplemental Security Income disability benefits. *Arch Pediatr Adolesc Med*. 1999;153:80–84.
22. The Henry J. Kaiser Family Foundation. Market share and enrollment of largest three insurers—large group market. Available at: http://kff.org/other/state-indicator/market-share-and-enrollment-of-largest-three-insurers-large-group-market/?currentTimeframe=0. Accessed June 16, 2017.
23. National Committee for Quality Assurance. *Technical Specifications for Health Plans: 2018 HEDIS Volume 2*. Washington, DC: National Committee for Quality Assurance; 2017.
24. Chien AT, Newhouse JP, Iezzoni LI, et al. Socioeconomic background and commercial health plan spending. *Pediatrics*. 2017;140:e20171640.
25. Simon TD, Cawthon ML, Stanford S, et al. Pediatric Medical Complexity Algorithm: a new method to stratify children by medical complexity. *Pediatrics*. 2014;133:e1647–e1654.
26. Mangione-Smith R, Schiff J, Dougherty D. Identifying children's health care quality measures for Medicaid and CHIP: an evidence-informed, publicly transparent expert process. *Acad Pediatr*. 11(3 suppl):S11−S21.
27. American Medical Association. CPT® (Current Procedural Terminology). Available at: https://www.ama-assn.org/about-us/cpt-editorial-panel. Accessed February 23, 2017.
28. U.S. Food & Drug Administration. National Drug Code Directory. Available at: http://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm. Accessed February 23, 2017.
29. U.S. Bureau of Labor Statistics, New England Information Office. Consumer price index Boston-Brockton-Nashua, MA-NH-ME-CT (1982-84 = 100). Available at: https://www.bls.gov/regions/new-england/news-release/2017/consumerpriceindex_boston_20170811.htm. Accessed January 1, 2016.
30. Song Z, Rose S, Chernew ME, et al. Lower- versus higher-income populations in the alternative quality contract: improved quality and similar spending. *Health Aff*. 2017;36:74–82.
31. Bai G, Anderson GF. US hospitals are still using chargemaster markups to maximize revenues. *Health Aff (Millwood)*. 2016;35:1658–1664.
32. Arora V, Moriates C, Shah N. The challenge of understanding health care costs and charges. *AMA J Ethics*. 2015;17:1046–1052.
33. Krieger N, Chen JT, Waterman PD, et al. Painting a truer picture of US socioeconomic and racial/ethnic health inequalities: the Public Health Disparities Geocoding Project. *Am J Public Health*. 2005;95:312–323.
34. US Census Bureau. American Community Survey Information Guide. Available at: http://www.census.gov/programs-surveys/acs/about/information-guide.html. Accessed February 23, 2017.
35. Berry JG, Hall M, Neff J, et al. Children with medical complexity and Medicaid: spending and cost savings. *Health Aff (Millwood)*. 2014;33:2199–2206.
36. Kuo DZ, Hall M, Agrawal R, et al. Comparison of health care spending and utilization among children with Medicaid insurance. *Pediatrics*. 2015;136:1521–1529.
37. American Medical Association. *Competition in Health Insurance: A Comprehensive Study of U.S. Markets, 2016 Update*. Chicago, Ill: AMA; 2016.

38. Liptak GS, Orlando M, Yingling JT, et al. Satisfaction with primary health care received by families of children with developmental disabilities. *J Pediatr Health Care*. 2006;20:245–252.
39. Toomey SL, Chien AT, Elliott MN, et al. Disparities in unmet need for care coordination: the national survey of children's health. *Pediatrics*. 2013;131:217–224.
40. Institute of Medicine. *Child and Adolescent Health and Health Care Quality: Measuring What Matters*. Washington, DC: National Academies Press; 2011.
41. Mangione-Smith R, DeCristofaro A, Setodji C, et al. The quality of ambulatory care delivered to children in the United States. *N Engl J Med*. 2007;357:1515–1523.