Small Geographic Area Variations in Prescription Drug Use

WHAT’S KNOWN ON THIS SUBJECT: Prescribing patterns in the US pediatric population are changing but not uniformly. A detailed examination of prescription variation is needed to better understand pharmacotherapy of children and to inform future exploration of the causes and consequences of diverse practices.

WHAT THIS STUDY ADDS: We examine pediatric pharmacotherapy and quantify payer type differences and small geographic area variation. Substantial payer-type differences and regional variations were found, likely reflecting local practice cultures. Variation was greatest for medications used in situations of diagnostic and therapeutic uncertainty.

BACKGROUND: Despite the frequency of pediatric prescribing little is known about practice differences across small geographic regions and payer type (Medicaid and commercial).

OBJECTIVE: The goal of this research was to quantify variation in prescription drug use among northern New England children.

METHODS: Northern New England, all-payer administrative data (2007–2010) permitted study of prescriptions for 949,821 children ages 0 to 17 years (1.75 million person-years [PYs]; 54% Medicaid, 46% commercial). Age- and gender adjusted overall and drug group–specific prescription use was quantified according to payer type (Medicaid or commercial) and within payer type across 69 hospital service areas (HSAs). We measured prescription fills per PY (rate) and annual, mean percentage of the population with any drug group–specific fills (prevalence).

RESULTS: Overall mean annual prescriptions per PY were 3.4 (commercial) and 5.5 (Medicaid). Generally, these payer type differences were smaller than HSA-level variation within payer type. HSA-level rates of attention-deficit/hyperactivity disorder drug use (5th–95th percentile) varied twofold in Medicaid and more than twofold in commercially insured children; HSA-level antidepressant use varied more than twofold within each payer type. Antacid use varied threefold across HSAs and was highest in infants where commercial use paradoxically exceeded Medicaid. Prevalence of drug use varied as much as rates across HSAs.

CONCLUSIONS: Prescription use was higher among Medicaid-insured than commercially insured children. Regional variation generally exceeded payer type differences, especially for drugs used in situations of diagnostic and therapeutic uncertainty. Efforts should advance best pediatric prescribing discussions and shared decision-making. Pediatrics 2014;134:563–570
Prescription drugs are a common and important component of children’s health care. In 2010, a total of 2.64 million prescriptions were dispensed to children aged <18 years in the United States or ~4 prescriptions per child per year. Although prescription use among children in the United States seems to be decreasing, this general trend masks heterogeneous changes across diverse drug groups. From 2002 to 2010, the reported decrease in number of prescriptions written for children was largely driven by a decline in antibiotic prescribing, while use of other drug classes, including select psychotropic agents and antacids, increased. Drivers of these diverse utilization trends for distinct drug groups are not well understood.

Pediatric prescribing of specific drug groups has been shown to vary across large geographic areas and across select populations. For example, studies of psychotropic use have highlighted differential increases in prescribing across payers and across populations defined by socioeconomic standing, race, or ethnicity. Medicaid-enrolled children consistently fill more psychotropic prescriptions than the commercially insured, but even among the Medicaid insured, use of certain drug groups such as stimulants varies substantially across regions of the United States (ie, west, midwest, south). Although others have described the influence of payer and geographic region on pediatric pharmacotherapy, little is known about regional variation in prescription use at the level of health care markets.

In this population-based study of an all-payer claims data set for northern New England, we examine differences in use of diverse drug groups across payer-types (Medicaid versus commercial insurance), and across small geographic areas within payer-type. We control for population differences in gender, age, and payer to quantify variation in local patterns of care for children.

METHODS

Data and Population

This study used pediatric all-payer administrative data sets for northern New England states (New Hampshire, Vermont, and Maine). The data, resulting from state-level efforts to develop comprehensive health care claims data sets, include all claims meeting state-level data-reporting mandates for children ages 0 to 17 years with one or more months of enrollment in a commercial or Medicaid insurance plan, 2007–2010 (Maine Medicaid data were not available July 2009–December 2010). To achieve statistically stable populations necessary for small area variation analyses, the 4 years of data were combined. Categorized by state, payer, and region, these children’s insurance enrollment months served as the denominators for prescription drug use calculations.

Main Measures

Outpatient prescription fills for each person-month of enrollment were used to develop 2 complementary prescription use measures: (1) prescription fills per 100 person-years (PYs); and (2) the annual average proportion of the population with any use of a particular medication type. Together, these measures reveal how many fills the population received and the proportion of the population over which all observed fills were distributed. Preliminary analysis of drug use over time revealed no significant trends. We attributed this to our relatively short data span (2007–2010) and did not pursue further description of secular trends.

We measured prescription fills overall and for select groups of drugs including: (1) prescription antacids (proton pump inhibitors and histamine₂-receptor antagonists); (2) antidepressants; (3) antipsychotics; (4) attention-deficit/hyperactivity disorder (ADHD) drugs; and (5) antibiotics (Supplemental Appendix Tables 1 and 2). Specific drug groups analyzed were drawn from those appearing most frequently in the claims of our enrollment cohort; prescription antacids were considered because of recent focus on their increasing use among pediatric prescribers. Asthma medications, while common, were not specifically examined in this descriptive study due to the complex interactions between maintenance and rescue treatments that warrant a methodologically distinct examination. In addition, commonly prescribed oral contraceptives were not specifically studied because these medications are frequently accessed through family planning clinics that do not uniformly bill insurance, the source of our data. For overall fill measures, we did not include claims for fluoride because use of this product is influenced by local water fluoridation. To test the validity of prescription fill count as a measure of prescription use, payer and year-specific days’ supply per prescription fill were and compared across payer, state, and year. Fills were found to be a stable measure of prescription drugs received (Supplemental Appendix Table 3).

Covariates

Each patient-month was categorized according to age, gender, and payer (Medicaid or commercial). Residential ZIP codes were used to link each child to 1 of the 3 states of study and to 1 of 69 HSAs. HSAs are relatively self-contained...
geographic health care markets defined initially with Medicare utilization data but validated for the purposes of this pediatric health services research through calculated localization indices. Localization indices were defined as the percentage of health care events for children residing in an HSA provided by clinicians within that HSA. The mean localization index overall for outpatient visits in our data was 71% (5th–95th percentile range: 35%–84%); the mean for emergency department visits was 74% (5th–95th percentile range: 48%–89%). Localization indices calculated according to payer type were very similar (Supplemental Appendix Table 4).

### Analysis

We calculated age- and gender-adjusted population prescription use measures overall, by payer type (Medicaid or commercial), by state-specific payer (eg, Maine Medicaid, Vermont [commercial]), and by HSA within each payer type. Diagnoses were not used to adjust drug use measures because studies using claims have shown that diagnostic ascertainment correlates with the intensity of health services use but only very weakly with meaningful health outcomes in adults.14,17–19 Drug use was measured according to age group (0–2, 3–4, and 5–9 years), but we present only age group–specific data for antacid use, with the 0- to 2-year-old age group further stratified into 0- to 1-year-olds and 1- to 2-year-olds. These data are selectively presented because antacids were the only drug group for which a remarkable age group pattern emerged. For graphic displays, to address the broad range of scales for distinct drug group use, we calculated the ratio of the observed (HSA-adjusted) rate to the expected (northern New England) rate of use of each drug for each HSA, stratified by payer type. To achieve measures of treatment prevalence, we calculated observation-time-weighted overall, payer type–specific, and HSA-level age- and gender-adjusted annual mean proportion of the population with any use of each drug group.

Pearson’s coefficient was used to assess correlation between HSA-level use of specific drug groups across payers (eg, Medicaid versus commercial use of ADHD medications) and to assess the correlation in use of specific drug groups, regardless of payer (eg, the correlation between antipsychotic agents and ADHD medications). The Committee for the Protection of Human Subjects at Dartmouth College approved this study. Analyses were conducted by using SAS version 9.3 (SAS Institute, Inc, Cary, NC) and Excel 2010 (Microsoft Corporation, Redmond, WA).

### RESULTS

In total, 949,821 individuals aged 0 to 17 years contributed 1.75 million PYs from 2007 through 2010, with a mean follow-up time of 22.1 months. Overall, 53.9% of observed PYs were insured by commercial plans and 46.1% by Medicaid. Payer-specific PYs ranged from 216,929 (Vermont, Medicaid) to 402,203 (Maine, commercial) (Table 1).

#### Differences Across and Within Payer Type

Overall, age- and gender-adjusted prescription fill rates were higher among Medicaid-insured children than among commercially insured children: 572 vs 346 fills per 100 PYs, respectively. Differences in drug use by payer type were larger for some medication groups than for others. Antibiotics were the most commonly used medications, and their use differed the least across payers. Antibiotics accounted for 18.8% of all fills. Within each year studied, on average, 37.9% of Medicaid-insured children filled an antibiotic prescription (84.6 fills per 100 PYs), whereas 33.3% of commercially insured children filled a prescription (79.3 fills per 100 PYs). Drug use differences by payer were more striking for psychotropic agents. For example, for ADHD medications, which comprised 12.8% of all fills, 7.7% of Medicaid-insured children filled at least 1 prescription (84.0 fills per 100 PYs), whereas 4.2% of commercially insured children filled at least 1 prescription (34.1 fills per 100 PYs). Antidepressants comprised 4.9% of all fills; 3.8% of Medicaid-insured children received an antidepressant (29.0 fills per 100 PYs), whereas 2.7% of commercially insured children received an antidepressant (16.3 fills per 100 PYs). Antipsychotic use followed a similar trend (Table 2).

Prescription antacid use was also higher among Medicaid-insured children (2.9% with ≥ 1 fill, 11.8 fills per 100 PYs) compared with the commercially insured (1.7% with ≥ 1 fill, 7.6 fills per 100 PYs). Overall, use of antacids was highest among 0- to 2-year-olds (21.3 fills per 100 PYs overall); rates in this age group ranged from 29.6 fills per 100 PYs (Vermont, Medicaid) to 58.1 fills per 100 PYs (Maine, commercial). When use among 0- to 1-year-olds and 1- to 2-year-olds was examined separately, the relationship between payer type and prescribing intensity for 0- to 1-year-olds was the reverse of that seen for drug groups in general. Among children aged <1 year, antacid use was higher among the commercially insured (34.1 fills per 100 PYs) compared with the Medicaid insured (37.5 fills per 100 PYs) (Fig 1).

#### Small Area Variation

In the 69 northern New England HSAs, area-specific PYs observed ranged from 1457 to 141,644. HSA-level analyses demonstrated substantial variation in nearly all age- and gender-adjusted measures of prescription fills. Overall, prescription fills per PY across HSAs varied more than twofold within

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<table>
<thead>
<tr>
<th>Payer Type</th>
<th>Total PYs</th>
<th>Medicaid PYs</th>
<th>Commercial PYs</th>
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<td>Total</td>
<td>1,750,000</td>
<td>921,000</td>
<td>829,000</td>
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<td>539,000</td>
<td>402,000</td>
<td>137,000</td>
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<td>Commercial</td>
<td>1,211,000</td>
<td>519,000</td>
<td>692,000</td>
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</table>

**Table 1: Total Prescription Fills by Payer Type**

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**Table 2: Prescription Fills by Payer Type and Age Group**

**Figure 1: Prescription Fills per PY by Payer Type and Age Group**

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**Figure 2: Geographic Variation in Prescription Fills**

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**Figure 3: HSA-Level Variation in Prescription Fills**

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**Figure 4: Correlation Between Payer Type and Prescription Fills**

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**Figure 5: Comparing Prescription Fills by Payer Type and Medication Class**

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**Figure 6: Small Area Variation in Prescription Fills**

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**Figure 7: Comparison of Prescription Fills Across Payer Types**

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**Figure 8: Prescribing Intensity by Payer Type and Medication Class**

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**Figure 9: Comparison of Prescription Fills by Age Group**

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**Figure 10: Small Area Variation in Prescription Fills by Age Group**
Medicaid-insured children, ranging from 3.4 to 8.1 fills per PY (5th–95th percentile: 4.6–7.4). Among the commercially insured, the corresponding HSA range was 2.1 to 5.2 (5th–95th percentile: 2.8–4.3). Among Medicaid-insured children, ADHD medication fills per 100 PYs varied more than threefold, with an HSA-level range of 39.7 to 130.4 (5th–95th percentile: 6.7–19.2); the corresponding commercial range was 1.2 to 11.7 (5th–95th percentile: 3.3–10.1). HSA-level variation was narrower for antibiotic use: Medicaid-insured range, 52.1 to 112.3 fills per 100 PYs; commercial range, 50.5 to 105.6 fills per 100 PYs (Fig 2, Table 3, Supplemental Appendix Table 5).

Small Area Prescription Use Correlations

Drug group–specific correlations in rate of prescription use between Medicaid-insured and commercially insured children were as follows: antibiotics, \( R = 0.69 \); ADHD medications, \( R = 0.46 \); antidepressants, \( R = 0.57 \); antipsychotics, \( R = 0.57 \); and antacids, \( R = 0.52 \). Considering all use (regardless of payer), HSA-level correlations between drug groups were strong for psychotropic agents but weaker between dissimilar drug types. For example, the correlation between antidepressant use and ADHD medication use was strong \( (R = 0.60) \); the same was true for antipsychotics and ADHD medications \( (R = 0.54) \). Conversely, there was no correlation between antidepressant use and antacid use \( (R = 0.04) \) (Supplemental Appendix Table 6).

DISCUSSION

This population-level study revealed substantial HSA variation in prescription drug use among children residing in northern New England. Although prescription use was higher in Medicaid-insured children compared with the commercially insured, substantial variation was found across HSAs, within payer type, even after controlling for age and gender. This finding suggests the importance of local clinician practice styles as one important determinant of drug use.\(^14,20\)–\(^22\) The majority of children residing in each HSA received most of their ambulatory care from within HSA providers. Therefore, the HSA prescription use measures likely reflect the care pattern of each area’s clinicians.\(^22\) These findings may

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**TABLE 1** Distribution of Person Years (PYs) by Age, State, and Payer Type

<table>
<thead>
<tr>
<th>State and Payer</th>
<th>% of Total PYs</th>
<th>No. of Unique Children by Age</th>
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<tr>
<td></td>
<td>All</td>
<td>0 to 2 y</td>
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<tr>
<td>Maine</td>
<td>Commercial</td>
<td>23.0</td>
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<td>New Hampshire</td>
<td>Commercial</td>
<td>18.3</td>
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<td></td>
<td>Medicaid</td>
<td>18.3</td>
</tr>
<tr>
<td>Vermont</td>
<td>Commercial</td>
<td>12.7</td>
</tr>
<tr>
<td></td>
<td>Medicaid</td>
<td>12.4</td>
</tr>
<tr>
<td>Total PYs</td>
<td></td>
<td>1,752,422</td>
</tr>
</tbody>
</table>

Person years represent 949,821 unique individuals enrolled in a Medicaid or commercial plan for \( \geq 1 \) month, 2007 to 2010.

**TABLE 2** Age- and Gender-Adjusted Prescription Fill Measures (2007–2010) by to Drug Group, State, and Payer

<table>
<thead>
<tr>
<th>Drug Group</th>
<th>Proportion of all Fills</th>
<th>Overall Commercial</th>
<th>Overall Medicaid</th>
<th>ME Commercial</th>
<th>ME Medicaid</th>
<th>NH Commercial</th>
<th>NH Medicaid</th>
<th>VT Commercial</th>
<th>VT Medicaid</th>
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</tr>
<tr>
<td>Antibiotics</td>
<td>18.8%</td>
<td>79.3</td>
<td>84.6</td>
<td>74.6</td>
<td>80.4</td>
<td>81.2</td>
<td>86.7</td>
<td>85.2</td>
<td>86.8</td>
</tr>
<tr>
<td>ADHD medications</td>
<td>12.8%</td>
<td>34.1</td>
<td>84.0</td>
<td>33.7</td>
<td>94.1</td>
<td>37.4</td>
<td>79.5</td>
<td>30.1</td>
<td>78.2</td>
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<tr>
<td>Antidepressants</td>
<td>4.9%</td>
<td>16.3</td>
<td>28.0</td>
<td>16.9</td>
<td>31.9</td>
<td>17.3</td>
<td>28.1</td>
<td>14.0</td>
<td>26.5</td>
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<tr>
<td>Antipsychotics</td>
<td>3.6%</td>
<td>5.8</td>
<td>29.8</td>
<td>6.1</td>
<td>33.8</td>
<td>6.1</td>
<td>30.1</td>
<td>5.0</td>
<td>24.4</td>
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<tr>
<td>Antacids</td>
<td>2.2%</td>
<td>7.6</td>
<td>11.8</td>
<td>7.1</td>
<td>12.5</td>
<td>7.7</td>
<td>12.3</td>
<td>8.3</td>
<td>10.0</td>
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<tr>
<td>Prevalence of use:</td>
<td>annual proportion of</td>
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<tr>
<td>Antibiotics</td>
<td>33.3%</td>
<td>37.0%</td>
<td>32.8%</td>
<td>35.3%</td>
<td>35.8%</td>
<td>39.2%</td>
<td>35.5%</td>
<td>36.8%</td>
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<tr>
<td>ADHD medications</td>
<td>4.2%</td>
<td>7.7%</td>
<td>4.3%</td>
<td>8.2%</td>
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<td>6.5%</td>
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<tr>
<td>Antidepressants</td>
<td>2.7%</td>
<td>3.8%</td>
<td>2.9%</td>
<td>4.1%</td>
<td>2.8%</td>
<td>3.6%</td>
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<td>Antipsychotics</td>
<td>0.7%</td>
<td>2.6%</td>
<td>0.7%</td>
<td>3.2%</td>
<td>0.8%</td>
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<tr>
<td>Antacids</td>
<td>1.7%</td>
<td>2.9%</td>
<td>1.7%</td>
<td>3.0%</td>
<td>1.6%</td>
<td>2.8%</td>
<td>1.9%</td>
<td>2.7%</td>
<td></td>
</tr>
</tbody>
</table>

Missing Maine Medicaid data from July 2009 through December 2010. Antacids include both proton pump inhibitors and histamine-2-receptor antagonists. The proportion of the population with \( \geq 1 \) fill is the mean of each annual prevalence value 2007–2010. ME, Maine; NH, New Hampshire; VT, Vermont.
reflect uncertainty regarding the indications and benefits of some drugs prescribed to children and a lack of consensus around best pediatric prescribing practice.

The higher drug use we observed among Medicaid-insured children confirms other studies on payer type–specific pediatric prescription use. The HSA-level variation we report enhances the geographic resolution of payer type–specific patterns and expands the scope of studied medications beyond psychotropic agents.10,12,13 Overall prescription use among Medicaid-enrolled children was 62% higher than use among the commercially insured. Across HSAs, within payer-type variation was notable. For example, for Medicaid enrollees, HSA-level ADHD medication fill rates varied more than twofold; antacid use varied approximately threefold (5th–95th percentile).

As with the variation seen among Medicaid enrollees, the overall commercial drug use rates mask HSA-level variations more than threefold for antipsychotics (5th–95th percentile) and antacids (5th–95th percentile). These findings suggest that the likelihood of receiving a prescription depends as much on where the child lives as on his or her socioeconomic status. The correlations observed between drug group–specific use rates and within drug groups across payers similarly support the role of prescriber practice style as a key determinant of children’s pharmacotherapy.

The important but, in relative terms, low level of variation in antibiotic use within payer type hints at potential sources of

![Figure 1](image1.jpg)

**FIGURE 1**
Antacid prescription fills per 100 PYs according to age group and state-specific payer type. The graphic portrays paradoxically higher rates of fills among commercially insured infants (compared with Medicaid-insured infants).

![Figure 2](image2.jpg)

**FIGURE 2**
Prescription fill rates in HSAs plotted as the ratio of observed use (area-adjusted rate) to expected use (overall northern New England rate), stratified by payer. Red dots are small HSAs (14 of 69); minimum number of children per area is 346 commercial and 525 Medicaid. Rate range is in legend.
the variation in pediatric prescribing observed in this study. Use of antibiotics differs from use of psychotropics in several ways. Antibiotics are more common overall, and differences in use must therefore be substantial to sway statistical variation measures. In addition, antibiotics have long been a popular subject of treatment guidelines, clinical quality measures, and national reports on overuse.1,4 Such consensus-promoting efforts have begun to emerge only recently for psychotropics.23–26 In addition, although substantial subjective judgment is involved in the decision to prescribe a course of antibiotics for acute illness, more may be required for the decision to prescribe psychotropic agents usually intended to treat chronic conditions and symptoms. Although there is a clear role for some psychotropics in the treatment of specific pediatric conditions,4,6 diagnostic and therapeutic uncertainty can be high for many clinical situations.4,27,28 For patients and families, cultural beliefs and social stigma surrounding medication use may also vary. These factors likely contribute to the relatively high level of variation observed in psychotropic prescribing.

The use of antacids seems subject to a distinct set of prescribing determinants. Little evidence supports the use of these drugs in children, especially for the very young.16 Despite a growing body of literature documenting overuse in the pediatric population, rates of antacid use continue to increase.29,30 The fact that proton pump inhibitor and histamine2-receptor antagonist use among infants (the age group with the greatest use) was twice as high in commercially insured children compared with Medicaid-insured children raises questions about the determinants of infant use of these drugs. Why would the usual and now expected pattern of diffusely higher prescription use in Medicaid-insured children be reversed for infant use of antacids? We can speculate that parents of commercially insured children advocate for treatment of common, and in most cases physiologic, reflux more than parents of Medicaid-insured children, but this theory cannot be inferred from our data. Based on the epidemiology of gastroesophageal pathology in this age group, the majority of this drug use is likely unwarranted.30 Although determinants of this practice remain unclear, this pattern highlights the need for dissemination and uptake of practice guidelines as well as clinician and parent education on the value and disadvantages of antacid use in the treatment of pediatric reflux.

The present claims-based study has a number of limitations. First, because diagnoses appearing in claims have been shown to be a poor substitute for true health status (in adults) we have not included these diagnoses in our analyses. This lack of association between claims diagnoses and health status has not been conclusively demonstrated for children. Such measurements in children are complicated by the relative dearth of meaningful health indicators and the very low rate of mortality, arguably the best indicator of health, in this population. In the absence of research quantifying the association between health and claims-based disease measurement, we aligned our approach in this study with the best available evidence of health care delivery patterns in the United States, which is derived from adult studies. Future studies should test this approach through examination of health services use in reliably identified, disease-specific pediatric cohorts. We believe this method is best for this study of prescription drug use.14,17–19 Nonetheless, meaningful differences in health states that are not accounted for with our age- and gender-adjusted, payer type–stratified analysis may result in an overestimate of unwarranted variation.

Second, some may worry that a few HSAs with a small number of children are driving observed variation. The HSAs for which we report prescription use measures have a minimum of 346 infants and children and 681 PYs. Figure 2 demonstrates that relatively small-population HSAs span the range of use for drugs studied. Therefore, overall rates are not unduly influenced by a few small-population HSAs.

### Table 3: Age- and Gender-Adjusted, Drug Group-Specific, Hospital Service Area Variation in Rates of Use (Prescription Fills Per 100 Person Years) by Payer Type

<table>
<thead>
<tr>
<th>Drug Group</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Median</th>
<th>Ratio of 5th/95th Percentile</th>
<th>Ratio of Maximum/Minimum</th>
<th>Coefficient of Variation</th>
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<td>Antibiotics</td>
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<td>ADHD medications</td>
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<td>79.2</td>
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<td>58.3</td>
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<td>27.0</td>
<td>24.6</td>
<td>2.82</td>
<td>4.41</td>
<td>0.34</td>
</tr>
<tr>
<td>Commercial</td>
<td>1.0</td>
<td>17.4</td>
<td>6.3</td>
<td>5.9</td>
<td>3.37</td>
<td>17.98</td>
<td>0.43</td>
</tr>
<tr>
<td>Antacids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>3.9</td>
<td>22.2</td>
<td>11.7</td>
<td>11.5</td>
<td>2.88</td>
<td>5.73</td>
<td>0.32</td>
</tr>
<tr>
<td>Commercial</td>
<td>1.2</td>
<td>11.7</td>
<td>6.9</td>
<td>6.9</td>
<td>3.09</td>
<td>9.47</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Antacids include both proton pump inhibitors and histamine, receptor antagonists. For commercial HSAs, n values ranged from 346 to 30 487 individuals (103–10 175 PYs). For Medicaid HSAs, n values ranged from 525 to 30 336 individuals (767–56 334 PYs).
Third, populations may differ across states and areas. Medicaid eligibility can vary across Maine, New Hampshire, and Vermont, resulting in differences in state-level average socioeconomic status of the Medicaid-insured population. Commercial enrollment eligibility and costs may be equally varied, resulting in unmeasured population differences across the regions studied. Similarly, northern New England is relatively homogeneous in terms of race and ethnicity. Although this makeup may limit the generalizability of our findings to more diverse populations, it also strengthens the study’s internal validity because race/ethnicity cannot reasonably be suggested as a source of the variation observed in this study. If racial and cultural differences increase health care variation, it is likely national variation in pediatric prescribing is even greater than that we observed in this relatively homogeneous population.

Fourth, Maine Medicaid data were not available for the latter months of 2009 (July–December) and all of 2010. Regional populations were sufficient despite this absence, but observed prescription use will not reflect any changes occurring in this later time frame among Maine Medicaid-insured children.

Lastly, our measure of prescription use counted prescription-fill events. These events have been shown to be a good proxy of medications consumed (in adults) and represent our best available measure at this regional level.31,32

CONCLUSIONS
The high levels of variation in use of psychotropic agents and antacids we observed suggest that practice styles substantially influence the pharmacotherapy experience of children. These findings should prompt discussion about the definitions and determinants of pediatric prescribing quality. In turn, these conversations should inform efforts aimed at developing a consistent approach to pediatric prescribing. Children and their families should be included in education efforts aimed at assuring sound prescribing practice, and shared decision-making should be a high priority, especially when treatment decisions involve relatively high levels of diagnostic and therapeutic uncertainty with trade-offs between benefits and risks.

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