



## Use of Adult-Trained Medical Subspecialists by Children Seeking Medical Subspecialty Care

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**Objectives** To quantify the use of adult-trained medical subspecialists by children and to determine the association between geographic access to pediatric subspecialty care and the use of adult-trained subspecialists. Children with limited access to pediatric subspecialty care may seek care from adult-trained subspecialists, but data on this practice are limited.

**Study design** We identified children aged <16 years in 2007-2012 Pennsylvania Medicaid claims. We categorized outpatient visits to 9 selected medical subspecialties as either pediatric or adult-trained subspecialty visits. We used multinomial logistic regression to examine the adjusted association between travel times to pediatric referral centers and use of pediatric vs adult-trained medical subspecialists for children with and without complex chronic conditions (CCCs).

**Results** Among 1.1 million children, 8% visited the examined medical subspecialists, with 10% of these children using adult-trained medical subspecialists. Compared with children with a  $\leq 30$ -minute travel time to a pediatric referral center, children with a >90-minute travel time were more likely to use adult-trained subspecialists (without CCCs: relative risk ratio [RRR], 1.94, 95% CI, 1.79-2.11; with CCCs: RRR, 2.33; 95% CI, 2.10-2.59) and less likely to use pediatric subspecialists (without CCCs: RRR, 0.66; 95% CI, 0.63-0.68; with CCCs: RRR, 0.76, 95% CI, 0.73-0.79).

**Conclusion** Among medical subspecialty fields with pediatric and adult-trained subspecialists, adult-trained subspecialists provided 10% of care to children overall and 18% of care to children living >90 minutes from pediatric referral centers. Future studies should examine consequences of adult-trained medical subspecialist use on pediatric health outcomes and identify strategies to increase access to pediatric subspecialists. (*J Pediatr* 2016;176:173-81).

The American Academy of Pediatrics states that access to appropriately trained pediatric subspecialists is necessary for optimal child health and well-being.<sup>1</sup> However, rising rates of chronic illness among children<sup>2</sup> and the limited supply of pediatric subspecialists<sup>1,3,4</sup> result in inadequate access to pediatric subspecialists for many children.<sup>5-7</sup> Nearly one-quarter of families report difficulty accessing needed specialty care,<sup>6</sup> and pediatricians report long wait times for referrals.<sup>7</sup> An unequal geographic distribution of pediatric subspecialists<sup>8-10</sup> creates further barriers, resulting in significant travel distances<sup>8</sup> and decreased subspecialty use<sup>11</sup> for many children.

Given these barriers to pediatric subspecialty care, children and their caregivers may instead seek care from adult-trained subspecialists. In the surgical fields, receipt of care from nonpediatric surgeons has been associated with worse outcomes, prompting recent guidelines describing specific clinical circumstances that warrant pediatric-specific expertise.<sup>12</sup> In contrast, little is known about children's use of adult-trained subspecialists in medical fields, such that even the quantity of care provided to children by adult-trained medical subspecialists is unknown. Using data from 1989-1992, 1 study found that between 6% and 41% of children with a range of chronic conditions visited only adult-trained medical or surgical subspecialists.<sup>13</sup> A subsequent study indicated that the proportion of visits by children to nonpediatric subspecialists declined from 2000 to 2006.<sup>14</sup> Over the last several decades, both the number of pediatric medical subspecialty fields and the number of subspecialists in each field have grown substantially.<sup>15</sup> Thus, there is a need to quantify the current use of adult-trained subspecialists by pediatric patients and to understand

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CCC	Complex chronic condition
FFS	Fee-for-service
MCO	Managed care organization
NPPES	National Plan and Provider Enumeration System
RRR	Relative risk ratio
SSI	Supplemental Security Income

the degree to which the wide variation in geographic access to pediatric subspecialists<sup>8,9</sup> is associated with adult-trained subspecialist use.

To examine this issue, we used a single-payer Medicaid dataset to examine the frequency at which children with and without complex chronic conditions (CCCs) use adult-trained subspecialists, and to determine whether decreased geographic access to pediatric subspecialists is associated with an increased use of adult-trained subspecialists.

## Methods

We examined 2007-2012 outpatient and professional claims data for Pennsylvania Medicaid beneficiaries, including those enrolled in managed care organization (MCO) and fee-for-service (FFS) plans. These data contain final action claims for all Pennsylvania Medicaid beneficiaries, and are provided through an ongoing partnership between the University of Pittsburgh and the Pennsylvania Department of Human Services. We identified children aged <16 years and examined subspecialty use during 24 months of claims for each child. We used 24 months of claims owing to the relatively infrequent occurrence of subspecialty care, because even children with special health care needs may see subspecialists less frequently than annually.<sup>11</sup> To allow adequate observation without requiring continuous enrollment, we excluded children enrolled for <20 of the 24 months. This study was approved by the University of Pittsburgh's Institutional Review Board.

Outpatient visits were identified using Current Procedural Terminology codes 99201-99215, 99241-99245, 99381-99397, and T1015. The visit provider was classified as 1 of 3 types: pediatric medical subspecialist, adult-trained medical subspecialist, or other. To classify providers, we linked National Provider Identifiers in the claims to the National Plan and Provider Enumeration System (NPPES),<sup>16</sup> which associates each provider with 1 or more self-identified taxonomy codes representing provider type and specialty and has an accuracy at least comparable to that of other national physician databases.<sup>17</sup>

We focused on 9 specific medical subspecialties: cardiology, endocrinology, hematology, infectious disease, gastroenterology, nephrology, neurology, pulmonology, and rheumatology. We selected these medical subspecialties because they have separate pediatric and adult training pathways, have distinct pediatric and adult NPPES taxonomy codes, and provide outpatient care. Visits to these subspecialists were categorized as either pediatric medical subspecialty visits or adult-trained medical subspecialty visits based on NPPES taxonomy codes. Subspecialists with both pediatric and adult-trained subspecialty taxonomy codes were classified as pediatric subspecialists for this analysis.

All remaining visits were categorized as "other." The majority of "other" visits were to generalist physicians (eg, general pediatricians, family practitioners), other physicians (eg, surgeons, psychiatrists, specialist physicians not included in

our 9 selected subspecialties), and nonphysician providers (eg, psychologists, optometrists). Provider type was identified for 96% of visits, with 4% unidentified.

To validate use of the NPPES taxonomy to categorize visits, we compared our rates of subspecialty care with those reported in the 2011-2012 National Survey of Children's Health<sup>18</sup> and the 2010 Medical Expenditure Panel Survey.<sup>19,20</sup> For the most similar comparison, we examined the Pennsylvania Medicaid claims using a broader definition of specialty physician (adult and pediatric medical and surgical specialists) and 1 year of claims (2011), resulting in 20.4% of children having a specialty visit in 2011 in the Pennsylvania Medicaid claims. Subspecialty utilization was reported for 25.6% of publicly insured children in Pennsylvania in the National Survey of Children's Health, and for 16.2% of publicly insured children nationally in the Medical Expenditure Panel Survey, indicating that our results are within the range of other estimates and strengthening the validity of our approach.

To measure geographic access, we used travel time to the closest pediatric referral center, because previous studies have indicated that the majority of pediatric subspecialists practice in such settings,<sup>21,22</sup> and also because of the known imprecision in locating individual subspecialists.<sup>22,23</sup> We identified pediatric referral centers in Pennsylvania using the list of children's hospitals in the Children's Hospital Association directory.<sup>24</sup> We excluded hospitals that offered  $\leq 2$  of the 9 identified pediatric subspecialties throughout the study period based on a review of hospital information and Medicaid claims, thereby focusing on centers providing relevant outpatient pediatric subspecialty care during the study period. For each child, we determined travel time to the pediatric referral center by calculating on-road travel time from the child's ZIP code centroid to the closest pediatric referral center using ArcGIS (ESRI, Redlands, California). Given the potential imprecision in using ZIP code centroids, we categorized travel time into 30-minute intervals to focus on relative travel time rather than on each additional minute of travel time. To assess the validity of travel time to a pediatric referral center as a measure of geographic access to pediatric subspecialists, we mapped county-level pediatric medical subspecialist counts from the Health Resources and Services Administration Area Health Resource File<sup>25</sup> superimposed on identified referral center locations, allowing visualization of pediatric subspecialist supply relative to identified referral centers.

Using the claims, we defined additional variables associated with subspecialty care in the literature,<sup>5,13,26-32</sup> to examine their association with pediatric vs adult-trained subspecialist use. Age was determined at the beginning of the observation period based on date of birth. Race/ethnicity and Supplemental Security Income (SSI) eligibility were obtained from Medicaid enrollment files. Family income was estimated using ZIP code median household income from 2010 US census data, categorized by the 2012 federal poverty level. Medicaid type was determined from Medicaid enrollment data and was categorized as an MCO vs an FFS plan.

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