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RESEARCH BRIEFS

Ambulatory Subspecialty Visits in a Large Pediatric Primary Care Network

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Objective. To determine patterns of subspecialty utilization within a pediatric primary care network.

Data Sources/Study Setting. Paid claims from a large not-for-profit health plan for patients of The Pediatric Physicians' Organization at Children's, a network of private pediatric practices affiliated with Children's Hospital Boston.

Principal Findings. The subspecialty visit rate was 1.01 visits per subject-year. In 2007, 56.8 percent of subjects had no subspecialty visits, whereas 4.2 percent had ≥ 5 visits; the corresponding figures in 2008 were 54.1 and 4.5 percent, respectively. The most frequently visited subspecialties were Ophthalmology, Orthopedics, Dermatology, Otorhinolaryngology, and Allergy/Immunology. Visit rates varied sevenfold by practice.

Conclusions. Wide practice variability in pediatric subspecialty utilization suggests an opportunity for reducing unnecessary visits. Better integration between primary care and the most commonly used subspecialties will be needed to meaningfully reduce unnecessary visits and enhance value.

Key Words. Specialty care, utilization, pediatrics

In recent decades, U.S. health care costs have risen much faster than the overall rate of inflation, and they now consume over 16 percent of gross domestic product, the highest proportion in the world (Anderson and Frogner 2008; Hartman et al. 2009). Despite higher costs, the quality of U.S. health care appears to be no better than that of other industrialized countries (Davis et al. 2007; Anderson and Frogner 2008). A focus on specialty care at the expense of primary care has been blamed in part for this gap between cost and outcome (Phillips, Dadoo, and Green 2005; Starfield et al. 2005a). Indeed, specialty utilization is much higher in the United States than in other countries (Forrest et al. 2002, 2003), and effective

primary care reduces the need for specialty care and enhances value (Starfield, Shi, and Macinko 2005b).

There has been relatively little research on pediatric subspecialty utilization, with the last comprehensive study published over 10 years ago (Forrest et al. 1999a). That study and others demonstrated a broad array of medical and surgical subspecialties to which patients are referred and various reasons for referral, including assistance with diagnosis and management, need for surgery or other procedures, and parental request (Forrest et al. 1999a, 2000; Glade et al. 2002). In addition, research has shown that there is a wide variability in subspecialty referral rates among pediatricians, as well as lesser variability according to type of insurance, region, and demographics (Forrest et al. 1999a, 2003; Kuhlthau et al. 2004).

In the current health care context, especially in light of efforts to develop more efficient models of care such as accountable care organizations (Luft 2010), a detailed understanding of specialty care utilization is needed. Thus, to update and further delineate the details of pediatric subspecialty utilization, we analyzed medical claims from a single large not-for-profit health insurer for a large cohort of pediatric primary care practices that are part of a network affiliated with a children's hospital. We sought to define the population-based subspecialty utilization rate and to examine patterns of subspecialty utilization that might be important in designing a system that could deliver higher value pediatric care.

METHODS

We analyzed data on paid medical claims for HMO members of a single large not-for-profit health plan in Massachusetts for the 2-year period January 1, 2007 through December 31, 2008 for all patients of The Pediatric Physicians' Organization at Children's (PPOC), an independent practice association of privately owned pediatric primary care practices affiliated with Children's Hospital Boston. The PPOC consists of 73 practices in eastern Massachusetts with 208 primary care pediatricians; practices range in size from 1 to 10

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physicians. All practices are owned and operated independently, but they participate collectively in quality improvement.

Subjects were included if they were insured by the health plan and had a primary care physician from the PPOC for the entire 2-year study period. All visits to subspecialty providers were included in the analysis, except for visits with mental health providers which were not included in the database made available to the researchers for reasons of confidentiality. Subspecialty visits were identified as outpatient medical visits (Current Procedural Terminology codes 92002, 92004, 92012, 92014, 96150, 96152, 99201-5, 99211-5, 99241-5, and 99401-4) with any provider who was not located at the subject's primary care site. The subspecialty for each visit was assigned according to the numeric code supplied by the insurer for each claim. For nonprimary care visits for which a specialty code was not attached to the claim (i.e., for some visits a nonspecific code such as "pediatrics" or "outpatient" was supplied), the name of the servicing provider was searched through the Children's Hospital Boston physician directory and through the Massachusetts Board of Registry in Medicine physician database to determine the provider's specialty. If there was ambiguity (e.g., no specialty or multiple specialties listed, or more than one physician with the same first and last name), the subspecialty was assigned as "Unknown." All visits considered in this analysis required a referral from the primary care provider, as the subjects were all insured by an HMO plan requiring referrals for subspecialty visits.

Statistical analyses were performed with SAS version 9.2 (SAS Institute Inc., Cary, NC, USA). Comparisons of subject characteristics according to visit rate were performed by chi-square analysis for sex and Wilcoxon rank-sum test for age. Comparisons of visit rates according to practice and physician characteristics were performed by linear regression with a Poisson distribution and a correction factor for overdispersion. The final model examining between-practice variability contained the number of visits as the dependent variable and the following independent variables as fixed model effects: practice, subject age, subject sex, and the presence or absence of a complex chronic condition.

The study was approved by the Children's Hospital Boston Committee on Clinical Investigation.

RESULTS

Sixty-eight of the 73 PPOC practices were members for the entire study period and were included in the analysis. The cohort included 12,008 subjects

ranging from 0 to 20 years of age as of January 1, 2007; 5,898 (49.1 percent) were female and 6,110 (50.9 percent) male. There were a total of 24,291 subspecialty visits, yielding an overall subspecialty visit rate of 1.01 visits per subject-year. A total of 8,686 visits (35.8 percent) were coded as initial visits or consultations for a rate of 0.36 new referrals per subject-year.

The distribution of subspecialty visit rates is shown in Figure 1. In 2007 and 2008, 6,816 subjects (56.8 percent) and 6,499 subjects (54.1 percent), respectively, had no subspecialty visits. In 2007, 500 (4.2 percent) subjects had ≥ 5 subspecialty visits and these subjects accounted for 30.2 percent of all visits; in 2008, 581 (4.8 percent) subjects had ≥ 5 subspecialty visits accounting for 32.1 percent of all visits. The subjects with the highest subspecialty visit rates (≥ 5.0 visits/year) were somewhat older than the rest of the cohort (median age 12 versus 8 years for the remainder of the cohort, $p < .0001$) but there was no significant difference in sex distribution (52.6 percent female for the high-visit rate cohort versus 49.0 percent female for the remainder, $p = .18$).

Table 1 shows the distribution of visits according to subspecialty. The most frequently visited subspecialties were Ophthalmology/Optometry (5,486 visits; 228 visits per 1,000 subject-years), Orthopedic Surgery (4,009; 167/1,000), Dermatology (3,412; 142/1,000), Otorhinolaryngology (1,847; 77/1,000), Allergy/Immunology (1,569; 65/1,000), Neurology (1,129; 47/1,000), and Gastroenterology (1,025; 43/1,000); these seven subspecialties accounted for 76.1 percent of all visits. Subjects with the highest subspecialty visit rates (≥ 5.0 visits/year) visited the same top seven subspecialties as the overall cohort, albeit in slightly different order (Dermatology, Orthopedic Surgery, Ophthalmology/Optometry, Gastroenterology, Otorhinolaryngology, Allergy/Immunology, and Neurology, respectively) and these seven subspecialties accounted for 67.8 percent of all visits among the high-visit cohort. Overall, 29.6 percent of all subspecialty visits among the cohort occurred at the primary care network's affiliated tertiary-care children's hospital, with 70.4 percent occurring at other sites. The proportion of visits occurring at the children's hospital ranged from over 80 percent for some subspecialties (e.g., Pain Management, 98.7 percent; Urology, 86.3 percent; Neurological Surgery, 80.7 percent; and Nephrology, 80.4 percent) to fewer than 20 percent for other common subspecialties (Dermatology, 5.8 percent; Ophthalmology/Optometry, 11.8 percent; and Obstetrics/Gynecology, 13.7 percent).

The most common primary diagnoses for the 10 most frequently visited subspecialties are shown in Table 2. For certain subspecialties, a small number of diagnoses accounted for most visits, for example: "Eye and vision examination" (42.5 percent) and "Disorders of refraction and accommodation" (17.3

Figure 1: Distribution of Subspecialty Visits. Proportion of Subjects and Visits According to Number of Visits during the Calendar Years (A) 2007 and (B) 2008

Table 1: Number and Rate of Ambulatory Visits According to Subspecialty

<i>Subspecialty</i>	<i>Number of Visits</i>	<i>Visit Rate per 1,000 Subject-Years</i>
All subspecialties	24,291	1,011
Ophthalmology/Optometry	5,486	228
Orthopedic Surgery	4,009	167
Dermatology	3,412	142
Otorhinolaryngology	1,847	77
Allergy/Immunology	1,569	65
Neurology	1,129	47
Gastroenterology	1,025	43
Podiatry	667	28
Unknown subspecialty	648	27
Endocrinology	523	22
Cardiology	469	20
Obstetrics and Gynecology	446	19
Oral–Maxillofacial Surgery	375	16
Urology	371	15
Pulmonology	331	14
Plastic Surgery	283	12
General Surgery	271	11
Adolescent Medicine	252	10
Developmental Behavioral	236	10
Hematology Oncology	225	9
Hand Surgery	163	7
Clinical Genetics	125	5
Physical Medicine and Rehabilitation	110	5
Pain Management	79	3
Rheumatology	65	3
Infectious Disease	61	3
Neurological Surgery	57	2
Nephrology	46	2
Vascular Surgery	6	0.2
Radiation Oncology	3	0.1
Thoracic Surgery	2	0.1

percent) for Ophthalmology/Optometry; “Diseases of sebaceous glands” (49.7 percent) for Dermatology; “Nonsuppurative otitis media and Eustachian tube disorders” (36.9 percent) and “Chronic diseases of tonsils and adenoids” (11.8 percent) for Otorhinolaryngology; “Asthma” (30.5 percent), “Allergic rhinitis” (22.6 percent), and “Dermatitis due to substances taken internally” (12.3 percent) for Allergy/Immunology; and “Attention deficit disorder” (29.2 percent) and “Epilepsy and recurrent seizures” (12.0 percent) for Neurology.

To evaluate whether the subspecialty utilization rate varied across primary care practices, we analyzed visit rates by practice, adjusted for the age, sex, and the presence of a complex chronic condition (Feudtner et al. 2001;

Table 2: Most Common ICD-9 Diagnoses for Ambulatory Visits among Top 10 Subspecialties

		<i>Proportion of All Visits within Subspecialty</i>
<hr/>		
Ophthalmology/Optometry		
V72.0	Eye and vision exam	42.5
367.xx	Disorders of refraction and accommodation	17.3
378.xx	Strabismus	8.8
368.0x	Amblyopia	5.3
372.xx	Conjunctivitis	3.9
	Other	22.2
Orthopedic Surgery		
719.4x	Pain in joint	12.5
813.xx	Fracture of radius or ulna	11.0
737.xx	Curvature of spine	6.5
845.xx	Sprains and strains of joints and adjacent muscles	4.8
816.x	Fractures of one or more phalanges of the hand	4.7
	Other	60.5
Dermatology		
706.x	Diseases of sebaceous glands	49.7
216.x	Benign neoplasm of skin	13.9
078.1x	Viral warts	7.4
692.xx	Contact dermatitis and other eczema	4.8
691.xx	Atopic dermatitis and related conditions	4.4
	Other	19.8
Otorhinolaryngology		
381.xx	Nonsuppurative otitis media and Eustachian tube disorders	36.9
474.xx	Chronic disease of tonsils and adenoids	11.8
389.xx	Hearing loss	7.2
382.xx	Suppurative and unspecified otitis media	6.0
380.xx	Disorders of external ear	4.8
	Other	33.4
Allergy/Immunology		
493.xx	Asthma	30.5
477.x	Allergic rhinitis	22.6
693.x	Dermatitis due to substances taken internally	12.3

continued

Table 2. *Continued*

		<i>Proportion of All Visits within Subspecialty</i>
691.x	Atopic dermatitis and related conditions	4.1
708.x	Urticaria	3.4
	Other	27.1
Neurology		
314.xx	Attention deficit disorder	29.2
345.xx	Epilepsy and recurrent seizures	12.0
346.xx	Migraine	8.9
348.3x	Encephalopathy, not elsewhere classified	6.3
299.x	Pervasive developmental disorders	6.1
	Other	37.6
Gastroenterology		
789.0x	Other symptoms involving abdomen and pelvis	19.9
564.0x	Constipation	15.0
530.xx	Diseases of esophagus	16.6
783.xx	Symptoms concerning nutrition, metabolism, and development	8.7
555.xx	Regional enteritis	8.4
	Other	31.4
Podiatry		
078.1x	Viral warts	25.6
726.xx	Peripheral enthesopathies and allied syndromes	8.8
703.xx	Diseases of nail	7.8
681.xx	Cellulitis, abscess of finger and toe	7.3
732.x	Osteochondropathies	7.3
	Other	43.0
Endocrinology		
250.xx	Diabetes mellitus	25.6
783.43	Short stature	20.3
253.x	Disorders of the pituitary gland and its hypothalamic control	8.8
259.1	Precocious sexual development and puberty, not elsewhere classified	5.5
244.x	Acquired hypothyroidism	5.5
	Other	34.2
Cardiology		
785.2	Undiagnosed cardiac murmurs	13.2
427.xx	Cardiac dysrhythmias	8.7
786.5x	Chest pain	7.2
745.4	Ventricular septal defect	5.1
780.2	Syncope and collapse	6.4
	Other	59.3

Figure 2: Subspecialty Visit Rate by Practice, Adjusted for Age, Sex, and Presence of a Complex Chronic Condition

Note: White bars represent single physician practices, gray bars represent 2–4 physician practices, and black bars represent 5–10 physician practices.

Simon et al. 2010; Berry et al. 2011). The adjusted subspecialty visit rate varied over sevenfold by practice, ranging from 0.21 to 1.50 visits per subject-year (Figure 2). The complex chronic condition variable alone accounted for 28 percent of the variability among practices and addition of this variable to the model reduced the range between the 25th and 75th percentiles of the practice distribution from an intraquartile range of 0.39 visits per year before adjustment to 0.31 after.

We also examined the effects of provider characteristics on visit rates. After adjusting for subject sex, age, and the presence of a complex chronic condition, we found no effect of provider sex (0.92 [95% CI: 0.89–0.96] visits per subject-year for female physicians versus 0.92 [0.89–0.96] for males) or provider age (visit rate 0.97 [0.90–1.00] for physicians under 40 years; 0.96 [0.92–1.00] for physicians 40–49 years; 0.86 [0.82–0.90] for 50–59 years; and 0.91 [0.86–0.96] for 60 years and older). In terms of practice size, physicians

in groups of 2–4 physicians had lower visit rates (0.86 [0.81–0.90]) compared to those in solo practice (0.94 [0.90–1.00]) or in groups of ≥ 5 physicians (0.95 [0.91–0.98]). All variations according to physician characteristics were very small (no more than 10 percent variability) compared to the large differences observed among practices.

DISCUSSION

This study describes the current patterns of ambulatory subspecialty utilization among patients of a large primary care pediatric network. Our estimate that there was ~ 1 subspecialty visit per subject-year and that ~ 45 percent of subjects had one or more subspecialty visits within a given year are somewhat higher than rates in adults and children that have been reported previously. For example, Forrest et al. reported that ~ 33 percent of adults had a specialty visit during a year (Forrest et al. 2002) while ~ 24 percent of children did (Forrest et al. 2003); Kuhlthau et al. (2004) reported ~ 13 percent of children having a specialty visit within a year, although their analysis relied on parental report and excluded visits to ophthalmologists and obstetrician/gynecologists, the first and eleventh most commonly visited subspecialties in our analysis. We hypothesize that our higher visit rates reflect higher use of specialists in eastern Massachusetts, where there is an abundance of pediatric subspecialists available, but it also may reflect an increasing secular trend in specialty use, as the previous estimates were from roughly a decade ago. We also found that a large number of subspecialty visits (~ 30 percent of the total) were accounted for by a small number of children (~ 4 – 5 percent). These high utilizers were somewhat older than the overall cohort, but the subspecialties visited by them were not notably different. Further research to understand the characteristics of high utilizers of pediatric ambulatory subspecialty care and to compare them to high utilizers of inpatient care or to patients with high health care costs would be useful. Furthermore, studying the effects of care coordination or other interventions on the utilization patterns of high utilizers would be of interest.

In identifying the subspecialties most frequently visited by our subjects, we found that nearly three-quarters of all visits were to seven subspecialties—Ophthalmology/Optometry, Orthopedic Surgery, Dermatology, Otorhinolaryngology, Allergy/Immunology, Neurology, and Gastroenterology. These subspecialties would thus be potentially fruitful areas for primary care–specialty collaboration with the goal of enhancing value by improving the

primary care management of common conditions and reserving subspecialty consultation for situations in which specialized care can truly enhance outcomes. Certain commonly referred diagnoses—such as vision abnormalities in Ophthalmology/Optometry, fractures in Orthopedic Surgery, and chronic otitis media requiring tympanostomy tubes in Otorhinolaryngology—may require specialized procedural skill or technical expertise and thus would not be easy candidates for enhanced primary care management. However, other common diagnoses stand out as targets for more cost-effective primary care management based on the lack of specialized skills necessary for their management and the availability of guidelines for care. Examples of these would include acne (Strauss et al. 2007), asthma (National Heart Lung and Blood Institute 2007), chronic abdominal pain (Di Lorenzo et al. 2005), and attention deficit disorder (American Academy of Pediatrics 2000, 2001). The emergence of integrated care organizations involving primary care and specialty physicians collaborating to facilitate management of such conditions holds promise for the development of such initiatives. In some organizations, the case for more effective integration is strengthened by financial risk-sharing arrangements, such as shared savings and global payments.

On a local level, defining the sites receiving subspecialty referrals (e.g., hospital-based departments versus community-based private practices) may be important to such initiatives as well. In the case of our pediatric cohort, certain subspecialties, such as Urology, Neurosurgery, Nephrology, and Cardiology, are accessed almost exclusively at the affiliated tertiary-care children's hospital, whereas others, such as Dermatology, Ophthalmology/Optometry, and Allergy/Immunology, are dominated by specialists in the community. Primary care-specialty collaboration within largely hospital-based specialties can be readily imagined because such efforts would require the cooperation of only a single hospital-based department. Collaboration with specialties that involve many dispersed community providers would present a more formidable challenge for a hospital-centered integrated care network or accountable care organization.

A striking finding of our study is the over sevenfold variability in subspecialty utilization among primary care practices. Such wide practice-level variation has been demonstrated previously among pediatric (Forrest et al. 1999a) and adult (Calman, Hyman, and Licht 1992; Franks et al. 1999) providers, but the reasons for it have not been clearly defined. We found a minimal contribution associated with physician demographics. Indeed, previous research has indicated that most practice-level variability is probably due to hard-to-quantify factors such as patient medical complexity and social factors, provider

knowledge and risk tolerance, and specialist availability (Forrest et al. 1999b, 2002, 2006; Forrest and Reid 2001; Kuhlthau et al. 2004; Mulley 2009). Presumably, value would be optimized by appropriately referring patients who need the skill or expertise of a specialist to improve outcomes while minimizing referral of patients for whom specialty care adds cost without improving outcomes (Starfield et al. 2005a). More carefully defining this value proposition would be a fruitful, although challenging area for future research.

The major limitation of our study is its generalizability. Our subjects were all privately insured by a single not-for-profit insurance plan; subspecialty utilization may differ among children with other types of insurance. Furthermore, all subjects in this analysis reside near a major eastern U.S. city that has an extremely high concentration of pediatric subspecialists. Given the effect of so-called supplier-induced demand (Mulley 2009), the absolute rates of subspecialty utilization among children in other parts of the country, particularly areas with relative shortages of pediatric subspecialists, would likely be lower, but the magnitude of the difference is unknown. On the other hand, we hypothesize that the relative patterns of utilization, such as the subspecialties most often visited and the diagnoses most often made, are likely to be similar in other pediatric populations, but this hypothesis remains to be tested. A further limitation of our data involves the lack of visits to mental health providers. This would lead to the complete absence of psychiatric visits as well as an underestimation of the prevalence of visits for conditions such as attention deficit disorder which may be managed by a neurologist or a psychiatrist.

CONCLUSIONS

This study demonstrates that within a large integrated pediatric primary care network, there was approximately one subspecialty visit per child-year, with a small proportion of patients accounting for a relatively large number of visits. Wide variability in practice-level subspecialty utilization suggests the opportunity for reducing unnecessary referrals and enhancing value. Furthermore, certain specialties and specific diagnoses were very common reasons for referral and may be targets for enhanced primary care management and improved cost-effectiveness. Future studies could focus on better defining patient- and practice-specific factors associated with high pediatric subspecialty utilization, and the effectiveness of integrated specialty–primary care efforts to decrease unnecessary referrals.

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