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ORIGINAL ARTICLE

The effects of expanding outpatient and inpatient evaluation and management services in a pediatric interventional radiology practice

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Abstract
Background Despite a continuing emphasis on evaluation and management clinical services in adult interventional radiology (IR) practice, the peer-reviewed literature addressing these services — and their potential economic benefits — is lacking in pediatric IR practice.
Objective To measure the effects of expanding evaluation and management (E&M) services through the establishment of a dedicated pediatric interventional radiology outpatient clinic and inpatient E&M reporting system.
Materials and methods We collected and analyzed E&M current procedural terminology (CPT) codes from all patients seen in a pediatric interventional radiology outpatient clinic between November 2014 and August 2015. We also calculated the number of new patients seen in the clinic who had a subsequent procedure (procedural conversion rate). For comparison, we used historical data comprising pediatric patients seen in a general interventional radiology (IR) clinic for the 2 years immediately prior. An inpatient E&M reporting system was implemented and all inpatient E&M (and subsequent procedural) services between July 2015 and September 2015 were collected and analyzed. We estimated revenue for both outpatient and inpatient services using the Medicare Physician Fee Schedule global non-facility price as a surrogate.
Results Following inception of a pediatric IR clinic, the number of new outpatients (5.5/month; +112%), procedural conversion rate (74.5%; +19%), estimated E&M revenue (+158%), and estimated procedural revenue from new outpatients (+228%) all increased. Following implementation of an inpatient clinic reporting system, there were 8.3 consults and 7.3 subsequent hospital encounters per month, with a procedural conversion rate of 88%.
Conclusion Growth was observed in all meaningful metrics following expansion of outpatient and inpatient pediatric IR E&M services.

Keywords Evaluation and management · Interventional radiology · Outpatient clinic · Pediatrics

Introduction

Historically, interventional radiologists (IRs) have provided image-guided procedural services while participating minimally in the clinical management of patients. A relatively high reimbursement for procedures has provided an incentive to perform procedures in lieu of providing clinical care for patients [1]. However as other medical specialties have started incorporating endovascular, image-guided procedures into their practices, they have begun to compete for procedures traditionally performed by IRs [2]. Subsequently referrals from primary care physicians started shifting from IRs to medical and surgical specialists because the latter assumed the clinical responsibility of the patients [3].

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More recently, with concomitant emphasis from the Society of Interventional Radiology and implementation of a combined IR/diagnostic radiology residency, an increasing number of IRs have incorporated clinical patient care into their practices [4] in order to be viewed as part of the clinical care team [5]. Despite this emphasis and shift in practice, many IR practices simply lack a system to capture and bill for the evaluation and management (E&M) services provided [6].

Despite a continuing emphasis on E&M clinical services in adult IR practices, the peer-reviewed literature addressing these services and their potential economic benefits is lacking for existing and aspiring pediatric IR practices. The purpose of this study is to measure the financial and clinical effects of expanding pediatric interventional radiology E&M services through implementation of a pediatric interventional radiology outpatient clinic and an inpatient E&M service reporting system at a single tertiary-care children's hospital.

Materials and methods

This study was determined to be non-human subject research and deemed exempt from review by the institutional review board. We used outpatient patient clinic visit CPT codes (99201–99205, 99241–99245) to identify new patients (ages 0–18 years at the time of clinic visit). All patients were seen in a dedicated pediatric IR outpatient clinic between November 2014 (when the clinic was initiated) and August 2015. The pediatric IR clinic was established as part of the pediatric physician group, was available one half-day per week, and was staffed by a single pediatric IR physician and a single medical assistant using two clinic rooms. The clinic was housed within the pediatric outpatient clinic affiliated with and directly adjacent to the children's hospital. All outpatient pediatric IR clinic scheduling was handled by the organization's central scheduling team. Prior to November 2014, all pediatric patients were seen in an outpatient IR clinic that was housed in the adjacent adult outpatient clinic building with pediatric and adult appointments mixed in the same clinic sessions. For each new patient visit, clinical indications and subsequent procedures (performed at a later date in the interventional radiology suite) were recorded and revenue was calculated. Established patient follow-up visits were excluded from analysis. Data were compared to historical data comprising pediatric patients seen in the pre-existing general IR clinic for the 2 years prior (July 2012–June 2014) to implementation of the pediatric IR clinic.

For pediatric IR inpatient services, all inpatients for which E&M services were provided between July 2015 (when inpatient E&M billing began) and September 2015 were identified using CPT codes 99251–99255 (initial consultation) and 99231–99233 (subsequent hospital care). Prior to July 2015, no methods existed at the hospital for reporting inpatient IR E&M services. Electronic medical record templates were constructed for inpatient IR consults and IR progress notes in July 2015 both for documentation and charge capture. Data collection ended in September 2015 because of the implementation of the Interventional Statistical Classification of Diseases, 10th edition (ICD-10), which had substantial impact on coding for many diseases. Patient age and clinical indication were recorded for each inpatient encounter as well as whether a procedure was performed following E&M service. We calculated the estimated revenue for both E&M and procedural services.

As a surrogate for revenue from E&M and procedural services, the authors chose to use the national average allowable payments for global non-facility services under the Centers for Medicare and Medicaid Services (CMS) 2015 part B physician fee schedule (MPFS). This value was chosen as a surrogate for relative changes in revenue pre- and post-intervention because it has been used in similar peer-reviewed publications and reflects actual dollars that are exchanged when a billable service is provided (rather than what is charged) for a large segment of the population for which data are available and not proprietary [6, 7]. Data and statistical analysis, including a paired *t*-test, were performed using Microsoft Excel (Microsoft, Redmond, WA). A *P*-value less than 0.05 was considered statistically significant.

Results

Following inception of a pediatric IR clinic, the number of new patients (5.5/month; +112%) and procedural conversion rate (74.5%; +19%), defined as the number of patients having procedures performed divided by the number of patients, increased. Of note, all patients were new to the IR service and were not transferred from multi-disciplinary clinics in which IR physicians participated (e.g., vascular anomalies clinic). There was an increase in the number of procedures performed each month on outpatients seen in the clinic (+241%) as well as total monthly procedural revenue (+228%). Similar increases were observed in clinical E&M revenue per month (+158%). Mean age of the patients was unchanged (10.3 years versus 10.7 years). Additional findings are summarized in Table 1.

Additionally, after inception of the pediatric IR clinic, the complexity of patient visits increased, according to reported E&M CPT codes (Table 2). Notably, the percentage of moderate complexity and comprehensive complexity visits (CPT codes 99203–99204, 99242–99244) increased from 39.7% of all visits to 80.0% of all visits.

Table 1 Clinical metrics before and after implementation of a dedicated pediatric interventional radiology clinic

	Without pediatric IR clinic	With pediatric IR clinic	%Δ	*P*-value[c]
New patients (per month)	2.6	5.5	+112	0.002
Age of new patients (years)	10.7	10.3	--	0.354
Conversion rate (%)	62.5	74.5	+19	<0.0001
Estimated clinic revenue (per month)[a]	$234	$604	+158	<0.0001
# of procedures (per month)[b]	2.2	7.5	+241	<0.0001
Estimated revenue per procedure[a]	$4,967	$4,610	−7	0.484
Estimated procedural revenue (per month)[a]	$11,341	$37,185	+228	<0.0001

IR interventional radiology

[a] Revenue is estimated based on the national average allowable payments for global non-facility services under the Centers for Medicare and Medicaid Services (CMS) 2015 part B physician fee schedule

[b] The number of procedures performed on outpatient clinic patients per month

[c] *P*-value less than 0.05 was considered statistically significant

A shift in the types of diseases seen in the clinic was also observed (Table 3). Prior to inception of a dedicated pediatric IR clinic the most commonly reported ICD-9 codes were benign neoplasm of the bone (20.6%), pain in limb (6.3%), hemangioma not-otherwise-specified (4.8%) and lymphangioma, any site (4.8%). After establishment of a pediatric IR clinic, the most commonly reported ICD-9 codes were congenital lower limb vessel anomaly (25.5%), lymphangioma, any site (20.0%), and congenital anomaly of the peripheral vascular system (14.5%). The most commonly reported procedural CPT codes resulting from new outpatient visits before the establishment of a clinic were congenital vascular anomaly embolization/sclerotherapy (35.0%) and percutaneous cryoablation of bone (32.5%). Following the clinic's implementation, outpatient procedural CPT codes for congenital vascular anomaly embolization/sclerotherapy (73.8%), percutaneous cryoablation of bone (4.8%), and arteriovenous malformation embolization (4.8%) were most commonly reported.

Regarding inpatient E&M services, between July 2015 and September 2015, 8.3 new inpatient consults per month and 7.3 subsequent hospital encounters per month were reported. These E&M encounters resulted in 7.3 procedures per month, with a procedural conversion rate of 88% (Table 4). The most commonly reported inpatient ICD-9 codes were hyperbilirubinemia (17.0%), lymphangioma at any site (10.6%), deep vein thrombosis (8.5%) and abdominal mass (8.5%). Prior to July 2015, no inpatient E&M services were reported.

Discussion

The purpose of this manuscript is to describe the impact on a single pediatric IR practice following expansion of E&M services in both outpatient and inpatient settings. Increases

Table 2 Complexity of outpatient clinic visits based on reported E&M codes

CPT code[a]	MPFS[b] ($)	% of overall visits prior to pediatric IR clinic	% of overall visits after opening dedicated pediatric IR clinic
99202	75.46	60.3	20.0
99203	109.6	33.3	32.7
99204	166.73	3.2	5.5
99242	109.6	3.2	5.5
99243	109.6	-	27.3
99244	166.73	-	9.1

CPT current procedural terminology, *IR* interventional radiology, *MPFS* Medicare and Medicaid Services 2015 part B physician fee schedule

[a] 99202–99204 are CPT codes for new outpatient office visits; 99242–99244 are CPT codes for outpatient consultations. Larger CPT code numbers correspond to increasing complexity

[b] National average allowable payments for global non-facility services under the Centers for Medicare and Medicaid Services 2015 part B physician fee schedule

Table 3 Most common ICD-9 and CPT codes before and after implementation of a dedicated pediatric IR clinic

Without pediatric IR clinic		With pediatric IR clinic	
ICD-9	%	ICD-9	%
Benign neoplasm of bone, NOS (213.9)	20.6	Congenital lower limb vessel anomaly (747.64)	25.5
Pain in limb (729.5)	6.3	Lymphangioma (228.1)	20.0
Hemangioma (228.00)	4.8	Congenital anomaly of the peripheral vascular system (747.60)	14.5
Lymphangioma (228.1)	4.8		
CPT	%	CPT	%
Venous embolization/sclerotherapy (CPT 37241)	35.0	Venous embolization/sclerotherapy (CPT 37241)	73.8
Cryoablation, bone (CPT 20983)	32.5	Cryoablation, bone (CPT 20983)	4.8
		AVM embolization (CPT 37242)	4.8

AVM arteriovenous malformation, *CPT* current procedural terminology, *ICD-9* Interventional Statistical Classification of Diseases, 9th edition, *IR* interventional radiology, *NOS* not otherwise specified

were observed in the number of new clinic patients per month (+112%), estimated E&M clinical revenue per month (+158%), number of outpatient procedures for clinic patients per month (+241%) and estimated monthly revenue from procedures performed on clinic patients (+228%). These findings are similar to those findings described by Kwan and Valji [1], in that procedural volume and total revenue increased when a higher number of E&M services were provided in adult interventional radiology practices. Additionally, implementation of an inpatient E&M reporting service resulted in approximately 16 inpatient encounters per month in just the first 3 months following implementation.

Table 4 Clinical metrics following implementation of a dedicated pediatric IR inpatient E&M reporting system

New inpatient consults (per month)	8.3
[a]Conversion rate (%)	88
# of procedures (per month)	7.3
Subsequent hospital encounters (per month)	7.3
Total estimated E&M revenue (per month)	$1,442
Top ICD-9 codes (%)	
Hyperbilirubinemia	17.0
Lymphangioma	10.6
DVT	8.5
Abdominal mass	8.5
E&M CPT codes (%)	
New inpatient consults	
99221	17.0
99222	34.0
99223	2.1
Subsequent hospital encounters	
99231	36.2
99232	8.5
99233	2.1

CPT current procedural terminology, *DVT* deep vein thrombosis, *E&M* evaluation and management, *ICD-9* Interventional Statistical Classification of Diseases, 9th edition, *IR* interventional radiology

[a] Defined as the number of procedures divided by number of consults

There are a number of potential reasons for these increases. First, the IR clinic in which children were previously seen was located in an adult hospital/clinic, separate from the children's hospital and remote from pediatricians and pediatric subspecialists. Consequently data from these clinical encounters were located in a separate electronic medical record, which while still accessible by pediatricians, required additional steps to obtain. Additionally many of these procedures in teens and adolescents were performed at an adult hospital, which led to archiving of the procedural images on a separate picture archiving and communication system. Shifting the clinic to the pediatric hospital/clinic led to improved access to IR consult notes and procedural images for referring clinicians. Second, although the number of IR staff members did not change, an IR staff member with pediatric training was added to the faculty prior to implementation of the clinic. This might have impacted the perception of referring pediatricians and led to a heightened awareness of the IR clinic throughout the pediatric community as well as increased propensity to refer. Last, opening an IR clinic within the purview of the pediatric hospital/physicians group prompted the children's hospital to engage their public relations and outreach teams to promote the IR clinic to community pediatrics/subspecialists through continuing medical education events, hospital grand rounds, and electronic media. The absolute impact of any or all of these separate variables is unknown, and each could have confounded the results of this analysis. However these attributes associated with implementation of a dedicated pediatric IR clinic collectively represent the variety of reasons for which dedicated pediatric IR clinics can be successful and should be considered by IR practices that provide services for pediatric patients.

The findings from this pediatric-focused study fit with the results of analyses performed by prior authors related to increasing E&M services in adult IR practices. Duszak and

Borst [8] reported a 12-fold increase in the number of non-procedural clinical encounters by interventional radiologists with Medicare beneficiaries from 1993 to 2008. Kwan and Valji [1], in reviewing 2009 Medicare claims data, showed that interventional radiologists who were high E&M-level providers had higher total procedural charges, higher per procedure revenue, and performed a greater number of complex procedures. Last, White et al. [6], after implementing structured templates and a team-based approach (including interventional radiologists and billing/coding specialists), observed an increase in overall inpatient E&M billing charges (+831%) and work relative value units (+669%). Yet, despite these salient arguments for the financial and non-financial benefits of emphasizing E&M services in IR practices, provider-specific Medicare claims data show that more than half of self-designated interventional radiologists still did not bill for E&M services in 2012 [9].

An argument can be made against the value of investing in a clinical pediatric IR service. Thus in addition to the many intangible benefits to having an outpatient IR clinic [10], it is imperative for IRs to demonstrate the financial value of such a clinic to a practice group or hospital, as best outlined by Soares [11]. In our study, we demonstrated an estimated 228% increase in outpatient monthly procedural revenue following implementation of an outpatient pediatric IR clinic. Although it is beyond the scope of this study, an additional fiscal argument could be made that implementation of a pediatric IR clinic could drive additional revenue secondary to increased need for diagnostic imaging for referred patients [12].

There are several limitations to this study. Unlike in similarly conducted adult-focused studies, readily available Medicare claims data cannot effectively be used to study pediatric claims data. Thus our sample is limited to claims from a single institution. Second, it is impossible in this analysis to eliminate the potential confounding impact of hiring a dedicated pediatric IR physician prior to implementing the pediatric IR clinic. Thus the value of this analysis in evaluating the impact of implementation of a pediatric IR clinic is limited in the setting of an established pediatric IR practice with dedicated pediatric IR physicians. Rather this analysis might more accurately inform adult IR practices considering expansion of their pediatric IR services. Third, the data were collected over a relatively short time period: November 2014–August 2015 for outpatients, and July 2015–September 2015 for inpatients. The primary reason for ceasing data collection was the October 2015 implementation of ICD-10. The pediatric IR clinic was initiated in November 2014 and prior to July 2015, no mechanism for reporting inpatient E&M services existed. Fourth, revenue was estimated by using the 2015 MPFS rather than by calculating actual reimbursements, which in the pediatric population are predominantly from Medicaid and private payers. However the wide geographic variation between actual reimbursements for specific procedures, in addition to the proprietary nature of private payer reimbursements and limitations on publishing proprietary charge master data, renders MPFS-allowable payments a more reasonable surrogate for relative revenue comparisons pre- and post-intervention. It should be emphasized that the MPFS data should not be interpreted to represent actual revenue for pediatric IR practices. Last, it is unclear why the complexity of outpatient visits (Table 2) increased following implementation of the pediatric IR clinic. There were no coding training or education interventions for providers before clinic implementation. It is possible that use of a different health care entity's (the children's hospital physician group) coding team could have altered the E&M services reported.

Conclusion

Expanding outpatient and inpatient pediatric IR E&M services resulted in growth in all meaningful financial and volume-related clinical metrics. The results of this study serve to inform pediatric practice leaders contemplating similar initiatives.

Compliance with ethical standards

Conflicts of interest None

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