Pediatric Echocardiography by Work Relative Value Units: Is Study Complexity Adequately Captured?

Sowmya Balasubramanian, MD, Alaina K. Kipps, MD, Shea N. Smith, BSc, Theresa A. Tacy, MD, and Elif Seda Selamet Tierney, MD, *Stanford, California*

Background: Present resource-based relative value unit (RVU) assignment for echocardiography is based on Current Procedural Terminology (CPT) codes, which do not incorporate complexity of diagnosis, time spent for image acquisition, or interpretation of echocardiograms. The objective of this study was to determine whether CPT-based RVU assignment accurately reflects physician effort in performing and interpreting pediatric echocardiographic examinations.

Methods: Cardiac complexity category (CCC) and physician time for study interpretation of 123 echocardiograms (June to September 2013) were prospectively assigned. Categories included (1) focused effusion/function evaluation, (2) normal anatomy/focused preterm infant studies, (3) acquired heart disease, (4) congenital heart disease excluding single ventricles, (5) single ventricles including heterotaxy syndrome, and (6) hearts on mechanical support. Subsequently, a random sample of echocardiograms (March to August 2013) were retrospectively analyzed, and each study was assigned a CCC and an extrapolated median interpretation time (MIT) on the basis of prospective data collection. Assigned work RVUs based on CPT codes were recorded. Comparisons were made between CCC and time for study interpretation, work RVUs, number of images acquired, and total scan time.

Results: A total of 933 echocardiograms were analyzed: 198 (21%), 174 (19%), 98 (11%), 359 (35%), 84 (9%), and 20 (2%) studies in CCCs 1 to 6, respectively. Total scan time, MIT, number of images, and work RVUs were different among CCCs ($P < .0001$). However, among the more complex studies (CCCs 2-5), work RVUs were similar, while number of images obtained and MIT were different ($P < .001$). Correlation analysis showed no association between work RVUs and CCC, total scan, or number of images per study. Compared with older patients, work RVUs of studies in children <2 years of age were lower, while all other markers of study complexity were higher ($P < .05$).

Conclusions: Current CPT-based assignment of work RVUs does not discriminate study complexity and physician effort. The results of this study highlight the need for a refined system that accurately assesses physician effort in pediatric echocardiography. (J Am Soc Echocardiogr 2016;■:■-■.)

Keywords: Work relative value units, Pediatric echocardiograms, Congenital heart disease, Physician effort, Cardiac complexity

In the current era, the prevailing model used to describe, quantify, and reimburse physician services is the resource-based relative value scale.[1] In 1979, Hsiao *et al.*[2-4] proposed a resource-based cost assessment for medical and surgical services, which included components of physician work, practice costs, and opportunity costs of training. Subsequently, the Omnibus Budget Reconciliation Act of 1989 enacted by Congress incorporated the resource-based relative value scale, which reformed physician payments for Medicare recipients.[5] The Health Insurance Portability and Accountability Act of 1996

named Current Procedural Terminology (CPT) codes as the standardized codes for describing physician services.[5] Services are assigned values on the basis of billing code alone and as such do not account for the various aspects of physician work, including (1) time spent, (2) technical skill, (3) cognitive skill, and (4) stress incurred for an individual patient.[6] Furthermore, the current relative value unit (RVU) system does not reflect the complexity and variations observed in different patient populations that may require specific services and effort, nor does the system value the increasing expertise of a provider.[7] Although not the original intent of the RBRVS, today, RVUs are used to track physician productivity, provide financial incentives, and evaluate job performance.[1]

Current practice in pediatric echocardiography incorporates CPT matched RVUs to assess physician work. The use of the CPT-derived RVU methodology initially reflected patients covered under Medicare and thus was not inclusive of children. But subsequent adaptation of this system by state Medicaid programs warranted greater scrutiny to assess for disparities between services provided for adults and children.[5] Garson *et al.*,[7] in a study consisting of a

Abbreviations

CCC = Cardiac complexity category

CPT = Current Procedural Terminology

MIT = Median interpretation time

RVU = Relative value unit

technical advisory panel, compared cardiology services provided to children and adults and reported on a comparison between pediatric and adult cardiology work values. This rating panel concluded that work values were underestimated in 75% of pediatric cases and underestimated for 90% of echocardiography codes that were selected for comparison. The panel recommended that, at a minimum, modifiers to the CPT codes should be considered for certain cardiology procedures. In a more recent study, Bergersen et al.[6] reported that the time, skill, and stress inherent to performing cardiac catheterization for congenital heart disease are not captured by the current CPT matched RVU measurement. The objective of this study was to determine whether CPT-based RVU assignment accurately reflects physician work component in performing and interpreting pediatric echocardiographic examinations.

METHODS

This study was conducted in two phases; the first phase was prospective, with the aim of gathering data on physician-reported time for study interpretation and assignment of cardiac complexity categories (CCCs). The larger, retrospective phase followed to gather all other data points. The rationale for this study design was to allow us to collect data on variables such as interpretation time, which could not be collected retrospectively, and to pilot the CCCs in our laboratory. Data were gathered on transthoracic echocardiograms only; transesophageal and fetal echocardiograms were excluded.

Prospective Phase

We initially developed nine CCCs. These categories were aimed at encompassing all possible indications for pediatric echocardiography. The initial CCCs (I-IX) were developed by two investigators S.B. and E.S.S.T on the basis of cardiac anatomy, physiology, and clinical acuity and were provided to interpreting physicians as rough guidelines for the assignment of study complexity. This scale was intended to be ordinal, on the basis of increasing complexity of cases. The nine groups were later condensed into six groups (CCCs 1-6), as shown in Table 1; this was done to reduce overlap among categories and for ease of assignment. A tabulated data sheet was handed out to six pediatric cardiologists interpreting echocardiograms for a period of 3 months. Physicians were asked to score and record data on at least five studies per day.

Data sheets documented the following variables: (1) date of study, (2) study identification number, (3) initial study (yes/no), (4) preoperative study (yes/no), (5) estimated time for interpretation (minutes), and (6) CCC (I-IX). The reported median interpretation times (MITs) of studies and the assigned CCCs are also summarized in Table 1.

Retrospective Phase

Using the prospective data, we retrospectively assigned CCCs and the MITs pertaining to the respective CCCs in a random sample of 933 echocardiograms obtained in patients ≤19 years of age during

Table 1 Time for interpretation by self-report by cardiologists in a prospective cohort (*n* = 123)

Revised CCC	Revised score	Time for study interpretation (min), median (range)
Focused evaluation for function or effusion	1	10 (3-30)
Normal anatomy or focused study on preterm infant	2	15 (2-30)
Acquired heart disease/cardiomyopathy	3	17.5 (10-45)
Congenital heart disease excluding single ventricle	4	25 (6-60)
Single ventricles including heterotaxy syndrome*	5	20 (15-25)
Mechanical support (ECMO/VAD)	6	15

ECMO, Extracorporeal membrane oxygenation; *VAD,* ventricular assist device.

*Includes patients with single ventricle or heterotaxy syndrome (single-ventricle and biventricular circulation).

Table 2 Study characteristics (*n* = 933)

Cohort	*n* (%)
Initial studies	194 (21)
Preoperative studies	170 (18)
Sedated studies	29 (3)
CCC 1	198 (21)
CCC 2	174 (19)
CCC 3	98 (11)
CCC 4	359 (35)
CCC 5	84 (9)
CCC 6	20 (2)

6 consecutive months. In our department, the Centers for Medicare and Medicaid Services–assigned RVUs for the CPT codes are used, and for our analysis, CPT codes and work RVUs designated to each study were extracted from this assignment. In addition to CCC, other surrogate markers of study complexity were also collected. These included (1) total scan time, (2) CCC-based MIT as determined from the prospective phase of this study, (3) total number of images per study, (4) initial study, (5) preoperative study, (6) sedated study, and (7) whether the study was coded as a congenital heart disease study. Total scan time was calculated as the difference in time from the time stamps on the first and last images captured for each of the studies. The total number of images was calculated as the sum of the individual cine clips and still frames.

Analysis

Data are reported as mean ± SD, with exception of physician interpretation time, which is reported as a median (range). Dichotomous variables (preoperative vs nonpreoperative, sedated vs nonsedated, and initial vs follow-up study) were compared using the Mann-Whitney *U* test, while Kruskal-Wallis analysis of variance was used to compare multiple groups. Associations between work RVUs and