General Pediatric Attending Physicians’ and Residents’ Knowledge of Inpatient Hospital Finances

WHAT’S KNOWN ON THIS SUBJECT: Physicians have little knowledge of health care costs and charges. Studies suggest that education and awareness of hospital finances can decrease unnecessary utilization of resources. Little is known about pediatricians’ awareness of the economics of health care delivery in the inpatient setting.

WHAT THIS STUDY ADDS: Both general pediatric attending physicians and trainees acknowledged a limited understanding of hospital finances, and they demonstrated a lack of awareness of costs, charges, and reimbursements for inpatient care.

abstract

BACKGROUND AND OBJECTIVE: There is evidence suggesting that physicians have a limited foundation of knowledge on health care finances and limited awareness of hospital costs and charges. The objective was to analyze general pediatric attending physicians’ and residents’ knowledge of costs, charges, and reimbursements for care rendered in the inpatient setting.

METHODS: An online survey was administered to all general pediatric attending physicians who work on the inpatient service and the entire pediatric residency program at The Children’s Hospital of Philadelphia (CHOP) in spring of 2011. Participants’ estimates of costs, charges, and reimbursements for several common tests, medications, and services were obtained and analyzed.

RESULTS: A total of 38 attending physicians and 100 residents participated in the study (84% and 76% response rates, respectively). The majority of both attending physicians (71%) and residents (75%) characterized their understanding as “Minimally knowledgeable” or “Completely unaware”. Only 15% of attending physicians’ estimates and 11% of residents’ estimates were within ±25% of true values across all surveyed costs, charges, and reimbursements. Percent error did not vary by level of experience or self-reported knowledge for attending physicians and residents.

CONCLUSIONS: Attending physicians and residents demonstrated limited knowledge of costs, charges, and reimbursements as shown by a low accuracy of estimates and a high percent error, compared with the actual values. To meet expectations for competency in systems-based practice and to be effective stewards of medical resources, it appears that pediatricians need further financial education.

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KEY WORDS: cost, medical economics, graduate medical education, hospital medicine, policy

ABBREVIATIONS: ANOVA—analysis of variance

CHOP—Children’s Hospital of Philadelphia

CV—coefficient of variation

PGY—postgraduate year

Dr. Rock designed the study, designed the survey instrument, coordinated the data collection, carried out the statistical analyses, drafted the initial manuscript, and approved the final manuscript as submitted; Dr. Xiao performed statistical analyses, reviewed and revised the manuscript, and approved the final manuscript as submitted; and Dr. Fieldston conceptualized and designed the study, assisted with statistical analyses, helped draft the initial manuscript, and approved the final manuscript as submitted.

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Despite spending more than any other nation, Americans do not consistently receive high-value health care. Part of the foundation for providing such care, and assessing all aspects of benefits relative to risks, is assessing financial costs in relation to quality. Physicians’ ability to direct the use of health care resources prudently is improved with, and perhaps even predicated on, an accurate understanding of costs, charges, and reimbursements. Recently, the American College of Physicians called for physicians to practice “parsimonious care.” Yet, as a group, doctors receive limited training on health care finances. Previous investigations show that many providers are not knowledgeable about costs, charges, and reimbursements for care. The growing economic challenges confronting the health care system have led to repeated calls for competency in this domain, yet we have not witnessed this translating into improved physicians’ knowledge. Most studies on this topic have focused on medical students or physicians caring for adult patients. Our objective was to analyze general pediatric inpatient attending physicians’ and residents’ knowledge of the actual cost, charges to the patient, and insurance reimbursement for services rendered in the inpatient setting. Our primary outcome was the accuracy of participants’ estimates for these inpatient services according to physician characteristics.

**METHODS**

**Study Setting and Population**

An online survey was administered to inpatient general pediatric attending physicians (n = 45) and all pediatric residents (n = 131) at The Children’s Hospital of Philadelphia (CHOP), a non-profit academic hospital with >480 inpatient beds in Philadelphia, Pennsylvania.

**Study Instrument**

The survey was developed on the basis of medical literature, in particular the instrument used by Graham for internal medicine hospitalists. The current study extends further by including trainees and by asking for estimates of costs and reimbursements in addition to charges. The instrument was pilot-tested for clarity with 6 attending physicians and recently graduated residents. The instrument consisted of 13 questions for residents and 15 questions for attending physicians (Supplemental Appendix 1). Respondents were asked to provide demographic information and to rate their understanding of hospital finances on a 5-point Likert scale. Next, respondents were asked to provide the following estimates, to the nearest dollar: (1) the actual direct cost to the hospital and (2) the charge as billed to the patient for several common tests, medications, and services rendered in the inpatient setting; and (3) the average daily reimbursements for routine and ICU beds. Finally, respondents used a 5-point Likert scale to rate their willingness to learn more about billing charges and health care finances.

**Data Collection**

The survey was administered through SurveyMonkey (SurveyMonkey, LLC, Palo Alto, CA). Responses were tracked to determine which subjects had taken the survey, but participants’ names and other identifiers were not collected. Nonresponders and partial responders received up to 4 reminder emails. The survey remained open for 8 weeks from April to May 2011. The study was approved by the Institutional Review Board at CHOP. There were no financial incentives for respondents.

**Finance Data**

Charges were taken from the hospital’s Charge Description Master Procedure file. For physician services, the weighted averages of coding levels were used to obtain average history and physical and progress note charges. CHOP’s ratios of direct costs to charges (RCC), which are specific to each department (eg, pharmacy, radiology), were used to convert charges to estimated direct costs. This resulted in a cost that includes materials, supplies, and staff directly related to the provision of a service, but not indirect costs, such as overhead or depreciation. Average per diem reimbursement (the predominant reimbursement mechanism at CHOP), which took into account CHOP’s entire payer mix, was calculated by using patient accounts for those admitted and discharged from July 2010 through April 2011. First, we identified inpatient accounts that only had intensive care bed days throughout their entire stay and had an account balance of zero at the time of analysis to isolate charges or costs on patients without including ongoing care. Then we divided this net total by the number of ICU bed days resulting in the average per diem ICU reimbursement. To obtain routine bed average reimbursement, the net ICU revenue and net rehabilitation revenue were subtracted from the total inpatient revenue. The remaining revenue was divided by the total number of routine bed days (Supplemental Appendix 2 shows sample calculations).

These CHOP-specific values for direct cost, charge, and reimbursement were used when calculating the accuracy of respondents’ estimates. Due to the proprietary nature of cost and reimbursement values for a single institution and its payers, these specific amounts are not displayed. However, values from freestanding children’s hospitals were used to provide a comparative range of actual costs and charges. Specifically, these data come from 38 children’s hospitals in the United States.
Pediatric Health Information System, an administrative database including freestanding children’s hospitals in the United States. The 25th and 75th percentile costs and charges were obtained for each of the 11 activities across 38 hospitals, and were used to construct vertical reference-range bars shown in Figs 1 and 2.

Statistical Methods
Response data were summarized by using standard descriptive statistics (mean, SD, range, median, and interquartile range) for continuous variables such as cost estimates. Frequencies were used for categorical variables such as postgraduate year (PGY). An accuracy range was defined as ±25% around true values of cost, charge, and reimbursement (based on CHOP data only), as it is a commonly used margin of error. Estimates outside this range were considered inaccurate. We defined a percent error (|estimate – true value|/true value) to quantify the degree of estimation error. Each error represents the percent above or below the true value, and absolute values were used to avoid cancellation between positive and negative percent errors. To report variation of the estimates on a normalized scale, coefficient of variation (CV), defined as SD divided by the mean, was calculated for each service.

The descriptive statistics were compared between attending physicians and residents by using χ² or Fisher’s exact tests for categorical variables, and Wilcoxon rank-sum test for continuous variables. The two-sample t test was used when comparing CV. A nonparametric test of trend was used for the ordered categorical variables.

The average percent error of all estimates (cost, charge, and reimbursement) for each participant across all services is the primary outcome variable. Grouped average percent errors by postgraduate year are shown in Figs 1 and 2. CHOP, Children’s Hospital of Philadelphia; CT, computed tomography; MRI, magnetic resonance imaging; MRI Brain, computed tomography abdomen & pelvis; RRP, rapid respiratory panel.
were compared by using analysis of variance (ANOVA) by years of experience; self-reported knowledge; and for attending physicians, number of weeks on service and percent of work effort that is clinical. Partial responders (n=5) were included in descriptive statistics but excluded from ANOVA models. ANOVA was conducted for all levels in each category and as a bivariate analysis to compare highest versus lowest levels in each variable. For attending physicians, response categories were grouped as those who practiced <10 years versus more, those who spend <15 weeks per year on the inpatient service versus more, or those whose work effort was <50% clinical versus more. For residents, pairwise groups were made for PGY-1 and PGY-2 versus PGY-3 and PGY-4. For residents and attending physicians, pairwise groups for self-reported knowledge were those with none to minimal versus moderate to high. Statistical analyses were performed using Stata 11.0 (StataCorp, College Station, TX).

RESULTS

Of the 45 attending physicians and 131 residents surveyed, 38 attending physicians (84%) and 100 residents (76%) responded. Five residents did not answer questions about charges and reimbursements, yielding 95 residents (73%) who completed the entire survey. Demographic and baseline characteristics are reported in Tables 1, 2 and 3. The ranges of both attending physicians’ and residents’ estimates on cost, charges, and reimbursement were large (Table 4): the difference between the minimum and maximum estimates across all care services was, on average, more than 2 orders of magnitude apart (Figs 1 and 2). Despite large ranges for each item, the distribution suggests that the attending physicians and residents tended to rank items in order of actual expense. However, as a group, both attending physicians and residents overestimated costs while they underestimated charges and reimbursements: 66% of attending physicians and 72% of residents overestimated true costs while 82% and 72% underestimated charges, and 95% and 82% underestimated average reimbursements, respectively.

The CV of estimates was 105% (range, 49% to 164%) for attending physicians and 114% (range, 77% to 191%) for residents, with no difference between groups (P = .29). Estimates were not more dispersed for more expensive services, nor for one financial category (ie, cost, charges, or reimbursement) over another.

The average accuracy (the proportion of total estimates within 25% of true values across all care services) was 15% (SD = 8.2%) for attending physicians and 11% (SD = 6.7%) for residents (P = .002). Table 5 provides summative data on average accuracy and median percent error of the estimates. Between the 2 groups, only chest radiograph and complete blood count had statistically significant differences in proportions of physicians with accurate estimates (P < .05). The median percent errors for each care service were also similar between attending physicians and residents, as only 4 out of 28 care services differed significantly (P < .05). Estimation errors ranged from 0% to >5000%, and they were larger and more varied among costs than charges and reimbursements. Median errors for each of the 3 financial categories also revealed large differences among the categories (Fig 3).

In ANOVA models, average percent error among attending physicians was not associated with more experience; there were no significant associations with number of weeks per year as an inpatient attending (F = 0.47, P = .78) or duration in total years as an inpatient attending (F = 0.66, P = .52).

### Table 1: Characteristics of Survey Respondents

<table>
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<tr>
<th>Respondents</th>
<th>Responses (%)</th>
<th>n (%)</th>
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<tbody>
<tr>
<td>Residents (n = 131)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGY-1 (n = 48)b</td>
<td>51 (63)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>PGY-2 (n = 41)b</td>
<td>34 (83)</td>
<td>11 (3)</td>
</tr>
<tr>
<td>PGY-3 (n = 38)b</td>
<td>31 (82)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>PGY-4 (n = 4)c</td>
<td>4 (100)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

a Percentages refer to the proportion of each PGY class, whereas for attending physicians, they are proportions of total respondents.
b Number of residents per class, totaling 131 across all classes.
c Trainees in the fourth year of a combined residency in internal medicine and pediatrics.

### Table 2: Understanding of Hospital Finances

<table>
<thead>
<tr>
<th>Attending Physicians</th>
<th>Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Very knowledgeable</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Moderately knowledgeable</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Somewhat knowledgeable</td>
<td>7 (18)</td>
</tr>
<tr>
<td>Minimally knowledgeable</td>
<td>23 (59)</td>
</tr>
<tr>
<td>Completely unaware</td>
<td>4 (11)</td>
</tr>
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Cochran-Armitage trend test was used to compare the 2 groups, P = .476.

### Table 3: Willingness to Learn Hospital Finances

<table>
<thead>
<tr>
<th>Attending Physicians</th>
<th>Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>1 (Uninterested)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>2</td>
<td>1 (3)</td>
</tr>
<tr>
<td>3</td>
<td>7 (18)</td>
</tr>
<tr>
<td>4</td>
<td>12 (32)</td>
</tr>
<tr>
<td>5 (Very interested)</td>
<td>18 (47)</td>
</tr>
</tbody>
</table>

Cochran-Armitage trend test was used to compare the 2 groups, P = .722.
attending ($F = 1.03, P = .39$). For residents, PGY ($F = 1.1$, $P = .35$) did not show any significant association with average percent error, but self-reported knowledge ($F = 2.4$, $P = .07$) of finances trended toward it. Pairwise comparisons did not indicate that more experience (years, weeks on service, percent effort, or training level) or more self-reported understanding of finances had lower margins of error ($F$-test $P$-values $>.05$).

**DISCUSSION**

This study analyzes general pediatric inpatient attending physicians’ and residents’ knowledge of hospital finances at one institution. Both groups acknowledged a limited understanding of hospital finances. On average, only 15% of attending physicians’ estimates were within 25% of true values (considered accurate) and their median margin of error was 77%. Only 11% of residents’ estimates were within 25% of true values, with a median margin of error of 82%.

Our research suggests that physicians not only have an incomplete foundation of knowledge on health care finances, but also that knowledge does not improve with experience: attending physicians’ estimates were, on average, accurate only 4% more frequently than those of residents ($P = .002$). Given the
Fact that the day-to-day work of physicians does not include financial information, these results are not surprising. Furthermore, experienced attending physicians may not have had training in health care economics during medical school, whereas more recent graduates may have had such exposure. They even may have had undergraduate or graduate degrees in economics or business administration, a contemporary trend among physicians. While not statistically significant, the association between self-reported knowledge and average percent error for residents neared statistical significance \((P = .07)\), suggesting that a subgroup could help teach peers.

These findings are consistent with previous studies. In 1979, Dresnick et al\(^{16}\) found lack of knowledge regarding frequently ordered hospital billing items, with attending physicians scoring as poorly as medical students. Recently, hospitalists have been replacing general practitioners to provide inpatient care, and it has been proposed that focused practice could increase financial awareness.\(^{11}\) However, when asked about 14 common services, procedures, tests, and physician charges, adult hospitalists surveyed by Graham et al\(^{11}\) had only a 24.8% rate of estimating within a 30% margin of accuracy.

Beginning in medical school, students report inadequate training in medical economics.\(^{17,18}\) Yet, many have called for enhancing this education. The Accreditation Council for Graduate Medical Education (ACGME) in its Common Program Requirements \((\text{IV.A.5.g})[3]\) identifies Systems-Based Practice as 1 of the 6 core competencies. Specifically, residents must “incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate.”\(^{24}\) The subset on pediatrics specifies that programs must provide education on cost effectiveness, balancing cost and quality, health care organization, and financing.\(^{25}\) In 2011, Weinberger\(^{19}\) called for cost knowledge to be a seventh competency, noting that “it is the responsibility of the medical profession to become cost-conscious and decrease unnecessary care that does not benefit patients” and that current training goals “place relatively little emphasis on residents’ understanding of the need for stewardship of resources or for practicing in a cost-conscious fashion.”\(^{19}\) Presumably, doctors cannot fulfill their duty to understand cost-effective care without training, which the American College of Physicians is trying to address, for example, with its curriculum on cost-conscious care.\(^{26}\)

In addition to little training, limited price transparency and the inherent dynamics of a third-party payer system may also explain physicians’ lack of...
Charges, which vary considerably for the same hospital service, are occasionally made transparent to clinicians because patients receive billed charges and may make providers aware of them. The actual cost of services and reimbursements, however, are rarely revealed. In fact, they may be kept as proprietary information that cannot be disclosed under civil and/or criminal penalty.

Our current system shields physicians from knowing about costs, how they might change the amount spent, and how they might practice cost-conscious care. There are recent initiatives to increase price transparency and thereby increase cost-consciousness among physicians. However, the manner in which price transparency is implemented will determine its effectiveness.

Although limited, several studies have demonstrated that providing the charges for tests at the time of order entry can decrease utilization, resulting in financial savings without compromising quality, although sustainability and generalizability remain to be proven. These studies were performed at university-affiliated hospitals in several different settings: pediatric emergency department, pediatric ICU, general medicine service, and general surgery service. These studies suggest that physicians are price ignorant rather than price insensitive; providing physicians with the finances of diagnostic tests at the time of order entry may affect behavior and reduce utilization.

A physician’s ability to manage costs while delivering high-quality care is becoming increasingly important as health care spending increases at unsustainable rates, which has fueled the advent of new payment models such as accountable care. In these models, clinicians can share the rewards of providing high-value care, but they may also be held accountable for total expenditures by the participating population. Furthermore, medical professionals have an obligation as fiduciaries responsible for not only the patient’s clinical well-being, but also his/her financial well-being and that of the society that bears much of the cost. As Markle emphasized in his 1978 JAMA article, “Though good medical care will never be inexpensive, but it need not be extravagant and wasteful. When we learn what costs we are dealing with, we can wisely discriminate as to how we should invest others’ money in better health.”

Given the lack of knowledge and the need for improved awareness of the finances of health care delivery, trainees and practicing physicians should be educated on costs, charges, and reimbursements. In particular, physicians should understand the difference between costs, charges, and reimbursements; should realize that costs can be considered in many ways; should be aware that charges do not translate into reimbursements for all activities, particularly in per diem or case-based reimbursement; and should have some knowledge of costs associated with different activities. It may be useful to at least educate doctors with a relative scale, such as that used by travel guides, by showing scaled $-signs ($, $$, $$$) to portray ranges of costs and help clinicians prioritize. Or, they may need a “shopping cart” to illustrate the choices in real time.

In addition, supplying physicians with individualized utilization data has been shown to affect ordering behavior. As hospitals continue to engage clinical staff in value-enhancement or cost-reduction programs, providing physicians with knowledge of health care finances in conjunction with resource utilization and iatrogenic risk feedback may improve these efforts. However, each system or program designed to curb costs should have its clinical outcomes properly evaluated in small trials before widespread use.

The limitations of this study include that it is a single cross section evaluation at 1 urban pediatric medical center. However, the findings are probably not limited to our institution because this type of analysis has been conducted in other settings to similar effect. Second, there was difficulty in calculating costs, charges, and reimbursement of individual services (Supplemental Appendix 2). Specifically, there are many ways to consider costs in health care, including total, direct, indirect, variable, fixed, marginal, and allocated or unallocated. We do not know how respondents considered costs when asked to estimate “actual costs.” Some outliers seemed to confuse cost with charge, while others believed the hospital charged similar amounts to the actual cost of the service, or in some cases, less than cost. These findings suggest that some physicians have a lack of awareness that charges are multiples of direct cost.

Another potential reason for higher median errors for cost estimates than charge estimates is that costs are much lower than charges, so small absolute-value differences appear as large percent errors. The ranges of cost and charge data shown in Figs 1 and 2, however, suggest that even the “truth” in terms of costs and charges varies by institution. Nonetheless, the estimates from our respondents were substantially more varied than the 25th to 75th percentile values across these children’s hospitals. One benefit of showing this range is that respondents may have spent time at other institutions, where they may have learned about local costs or charges. Even so, most survey responses were outside of the cross-hospital range. Finally, average
reimbursements for an ICU and routine bed were also difficult to calculate and may have been challenging for respondents to pinpoint because there are many reimbursement models.

In summary, as shown in studies of adult providers, pediatricians had limited knowledge of charges, costs, and reimbursements. To meet educational expectations and to effectively create a value-based health care system, pediatricians appear to need more training in medical economics. Further research is also warranted on the most effective manner to educate pediatricians, and the long-term impact of such education on utilization, costs, and quality of care in inpatient and outpatient settings.

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STRIKING FEAR: I am easily terrified by scary movies. All my family members know this and while they tease me, they monitor television shows and movies and report if they are too scary for me to watch. It is a bit odd that I am so sensitive to visual cues in a movie, but do not suffer panic attacks and can swim for a long time under water. How we process presumed threats, which we turn into fear, seems to involve different parts of the brain. As reported in The New York Times (Health: February 3, 2013), researchers have been studying individuals with damage to the amygdala, an area deep within the medial temporal lobes of the brain long associated with fear. One woman, in particular, with bilateral amygdala damage, has voluntarily participated in numerous studies. She has never demonstrated any fear of scary movies, snakes, spiders or very real domestic assaults, death threats, and robberies at knife or gunpoint. However, after inhaling a gas mixture with 35% CO₂, she experienced a panic attack and reported intense fear. Two other women, also with bilateral amygdala damage that prevented them from developing fear to external stimuli, also panicked and reported fear during the same experiment. The exact reason for this finding is not known but one hypothesis is that different parts of the brain are responsible for responding to external and internal stimuli. The amygdala may be responsible for processing external threats and therefore, individuals with damaged amygdala are not scared by traditionally scary cues such as snakes and robbers. However, other parts of the brain, exactly where is not known, may be responsible for processing internal threats. For example, while humans are not particularly sensitive to carbon dioxide levels in the air, they are quite sensitive to how much is in the body. Rising carbon dioxide levels can cause panic or fear in most individuals. That is presumably why someone under water for a long time may begin to panic. I still do not know how the brain creates a conscious experience of fear, but I do know that for now I will continue to avoid scary movies (and staying under water for too long).

Noted by WVR, MD
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