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Patient-level Factors and the Quality of Care Delivered in Pediatric Emergency Departments

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Short Running Title: Factors Associated with Quality of Care in Pediatric EDs

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Abstract

Objective: Quality of care delivered to adult patients in the emergency department (ED) is often associated with demographic and clinical factors such as a patient's race/ethnicity and insurance status. We sought to determine whether the quality of care delivered to children in the ED was associated with a variety of patient-level factors.

Methods: This was a retrospective, observational cohort study. Pediatric patients (<18 years) who received care between January 2011 and December 2011 at one of twelve EDs participating in the Pediatric Emergency Care Applied Research Network (PECARN) were included. We analyzed demographic factors (including age, sex, and payment source) and clinical factors (including triage, chief complaint, and severity of illness). We measured quality of care using a previously validated implicit review instrument using chart review with a summary score that ranged from 5 to 35. We examined associations between demographic and clinical factors and quality of care using a hierarchical multivariable linear regression model with hospital site as a random effect.

Results: In the multivariable model, among the 620 ED encounters reviewed, we did not find any association between patient age, sex, race/ethnicity, and payment source and the quality of care delivered. However, we did find that some chief complaint categories were significantly associated with lower than average quality of care, including fever (-0.65 points in quality, 95% CI: -1.24, -0.06) and upper respiratory symptoms (-0.68 points in quality, 95% CI: -1.30, -0.07).

Conclusion: We found that quality of ED care delivered to children among a cohort of 12 EDs participating in the PECARN network was high and did not differ by patient age, sex, race/ethnicity, and payment source, but did vary by the presenting chief complaint.

Introduction

The quality of care delivered to patients in the United States (US) is highly variable.[1] Health services researchers continue to find relationships between the quality of care delivered to patients and a variety of patient-level factors, including age, sex, race/ethnicity and insurance status. In the emergency department (ED), investigators have found such patient demographic

factors among pediatric patients to be associated with disparities in triage,[2] diagnostic testing,[3-5] medication prescriptions,[6] wait times,[7,8] length of stay,[8,9] admission rate,[10] leaving without being seen,[11] and readmission.[12] Few studies, however, have examined whether or not demographic and other patient-level factors among children presenting to the ED are associated with overall measures of quality of care.

One of the major barriers to identifying differences in the quality of care delivered to children receiving care in the ED is the lack of general instruments that can be applied to the diverse case-mix of children typically treated in EDs. Outcome measures such as mortality, length of stay, recidivism, appropriateness of admission, and health-related quality of life may not be reliable if the outcomes are uncommon or not sensitive to changes in processes of care. Peer review continues to play an important role in ascertaining quality of care both at the individual provider and team-based levels.[13-15] Implicit review is a type of peer review in which assessments of quality of care are based on expert reviewers' judgment of care,[16] and has been used in both outpatient[17] and inpatient settings.[18,19] Structured implicit review of medical records to assess quality of care has been shown to have high face validity[14] and offers better inter-rater reliability[14,20] than unstructured review.[20]

Recently, we tested and validated an ED-specific implicit review instrument on a large sample of children treated in 12 EDs participating in the Pediatric Emergency Care Applied Research Network (PECARN).[21,22] This peer-review instrument encompasses four dimensions of care including the physician's initial data gathering, integration of information and development of appropriate diagnoses, initial treatment plans and physician orders, and plan for disposition and follow-up, as well as one item assessing the overall quality of care. We found that this instrument has high construct validity and the summary score (range 5 to 35) correlated well with condition-specific, criterion based explicit quality measures. Specifically, we found that a difference of 1.0 in the summary quality of care score was significantly associated with differences in quality as measured by these four condition-specific quality measures.[21,22]

The purpose of this study was to examine the association between the quality of care measured using this implicit review instrument and a variety of patient-level factors among a cohort of children receiving care in the ED. We hypothesized that some demographic factors such as age, sex, race/ethnicity, and payment source, and some clinical factors such as chief complaints and severity of illness would be associated with differences of greater than 1.0 in the

summary quality of care scores. Based on previous research,[7,23-27] we specifically hypothesized that racial/ethnic minority patients and those patients with either no insurance or public insurance would receive lower quality of care.

Methods

Study Design and Hospital Sample: This was a retrospective, observational cohort study of children presenting to 12 EDs participating in PECARN. PECARN is the only federally-funded pediatric emergency medicine research collaborative in the US, and at the time of the study, was comprised of four geographically distinct research nodes with 22 participating EDs. For the purposes of this study, we included three EDs from each of the four nodes for equal nodal representation. The three EDs were specifically selected to maximize clinician and patient diversity with differences between hospital size (large and small), treating physicians (general EM and pediatric EM), and patient populations (including racial/ethnic diversity).

Study Setting and Population: Children younger than 18 years of age who presented to any of the 12 study EDs for evaluation from January through December 2011 were eligible for inclusion. We randomly sampled patient visits from the ED logs at each of the study hospitals using a two-stage date and patient sampling scheme generated by the PECARN Data Coordinating Center. First, the study year was stratified into six, two-month blocks (January-February; March-April; etc.) to ensure an equal distribution of patient encounters throughout the calendar year. The sampling scheme then provided a list of random dates and an associated list of random numbers. For each randomly selected date, a patient encounter was identified from the ordered ED log according to the associated random number for that date. If the patient encounter did not qualify, the next randomly-sampled patient from that date was evaluated, until an eligible patient encounter was identified. The sampling scheme did not exclude medical records of patients that might have been previously selected, but did exclude medical records of children who were seen in the ED for scheduled procedures (e.g., suture removal), those transiently evaluated in the ED in the process of direct admission to the hospital, and those who left the ED without being seen by an attending physician. Based on previously reported sample size calculations used for the purposes of validating the implicit review instrument,[22] a minimum of 50 records were obtained and reviewed from each participating ED.

Study Protocol: After removing all patient, hospital and physician identifiers, the research coordinator at each participating hospital photocopied medical records of sampled patients. Essential components of the medical record included ED physician notes, triage nurse notes, ED nurse notes, all physician orders, all medication orders, laboratory results, and discharge instructions. Non-essential elements that were photocopied when available included radiology results and consultation reports. The research coordinator abstracted relevant patient data from each medical record and uploaded the de-identified record to a secure server at the PECARN Data Coordinating Center for review.

Quality of Care Score and measurement: The quality of care provided to each child in the ED was assessed using the previously published and validated implicit review instrument (Figure 1).[21,22] Briefly, this five-item instrument includes four items assessing different dimensions of care and one item assessing the overall quality of care. The four dimension-specific items focus on processes of care and include: the initial data gathering about acute problems; the integration of information and development of appropriate diagnoses; the initial treatment plan and orders; and the plan for disposition and follow-up. All five items were assessed on a seven-point ordered adjectival scale ranging from "extremely inappropriate" to "extremely appropriate." We then calculated a summary quality of care score, which was the sum of the five item-specific scores from each record, resulting in a score ranging from 5 to 35 for each patient.[21] In a recent publication, we demonstrated that the instrument had good internal consistency, moderate inter-rater reliability, and high inter-rater agreement. We also demonstrated evidence supporting validity in that the summary quality of care score correlated well with four condition-specific, criterion based explicit quality of care instruments for asthma, febrile seizure, diarrhea and dehydration, and head trauma).[21,22] Each de-identified medical record was randomly assigned to four of the eight physician reviewers for independent assessments of quality[21,28] who did not review records from their own institution. Prior to reviewing the medical records, all of the reviewers met for a one-day, in-person training session to review the manual of operations. The group discussed general principles of structured implicit review, how the instrument should be applied, outlined anchors for the adjectival scale, and reviewed several sample medical records both individually and as a group. Each reviewer was board certified in pediatric emergency medicine (PEM).

Patient and presentation level factors: Data abstracted from ED records included patient age, sex, race, ethnicity, triage category, illness severity scores (PRISA II[29] and RePEAT[30]), payment source/insurance type, chief complaint, time of ED arrival, day of presentation and disposition of care. Race and ethnicity were re-categorized into a single variable (Race/Ethnicity) using a previously described method.[5] PRISA II and RePEAT scores were categorized into tertiles for ease in interpreting associations with the quality measure. Chief complaints were categorized into Pediatric Emergency Reason for Visit Clusters (PERCs) (Appendix Table 1).[31] Each PERC was further collapsed into eight broad chief complaint categories (Appendix Table 2). Time of arrival was dichotomized into daytime (7:01am to 6:59pm) and nighttime (7:00pm to 7:00am). Day of presentation was dichotomized into weekday (Monday through Friday) and weekend (Saturday and Sunday).

Data Analysis: The mean summary quality of care score across reviewers was the main dependent variable in our analyses. For univariable analyses, we compared mean quality of care scores using the Student's t-test or ANOVA for categorical variables, and compared mean quality of care scores for continuous variables using linear regression, testing for significance using likelihood ratio tests. Pairwise comparisons for categorical variables with more than two levels were conducted using Tukey's Studentized Range (HSD) Test. Considering clinical and statistical associations from the univariable analyses, we also compared the association between the mean summary quality of care scores with age, sex, race/ethnicity, payment source and triage in a hierarchical multivariable linear regression model with hospital site as a random effect to account for clustering of observations by the source hospital. These demographic and clinical patient-level factors were chosen for inclusion *a priori*, based on our hypotheses. All analyses were performed using SAS Version 9.4 (SAS Institute, Cary, NC). P-values <0.05 were considered to be significant. This study was approved by the institutional review board at each participating hospital.

Results

A total of 620 ED encounters (all unique patients) were included in the study. Approximately 50 medical records (range: 47-55) were reviewed from each of the 12 participating EDs. As shown in Table 1, in the univariable analyses, the mean summary quality of care scores were significantly higher for boys and for patients with non-Hispanic white

race/ethnicity compared to patients with non-Hispanic black race/ethnicity. There was no statistically significant association between patient age and the mean summary quality of care score. Children with private insurance had significantly higher mean quality of care scores than those with public insurance or no insurance. In terms of clinical factors, the mean summary quality of care scores were positively correlated with the patient's triage level, with those patients triaged as urgent and emergent receiving higher quality than those triaged as non-urgent. Some of the chief complaint categories were positively and negatively associated with the mean summary quality of care score. Children with the chief complaint of trauma had a significantly higher mean summary quality of care score (31.2) than children with upper respiratory symptoms (30.2), fever (30.2) and abdominal pain (29.6). We did not find any clinically or statistically significant associations between the mean quality of care scores and the time of arrival to the ED, day of presentation to the ED, PRISA II scores or RePEAT scores. Higher average quality of care scores were recorded for patients who were hospitalized from the ED or transferred to another hospital compared to patients who were discharged home (Table 1).

In the hierarchical multivariable analysis, some of the chief complaint categories remained significantly associated with mean summary quality of care (Table 2); specifically those children presenting with fever and upper respiratory symptoms had lower quality of care scores by an adjusted mean of -0.65 points (95% CI: -1.24, -0.06) and -0.68 points (95% CI: -1.30, -0.07), respectively. Other patient-level factors including age, sex, insurance type, race/ethnicity and triage level were not significantly associated with mean quality of care scores after adjusting for other covariates (Table 2).

Discussion

We evaluated whether the quality of care delivered to children receiving treatment in the ED was associated with patient-level characteristics, including age, sex, race/ethnicity and payment source among a cohort of 12 EDs participating in the PECARN network. While racial and ethnic minorities and those with public or no health insurance had lower mean quality of care scores in univariable analyses, after adjusting for other demographic and clinical confounders, we found that these associations were neither clinically nor statistically significant. Unlike studies of adult patients receiving care in the ED, our results do not suggest disparities or biases in the quality of care based on patient demographic and insurance factors, after adjusting for other important factors and confounders.

In our study, we did find that quality of care was most significantly associated with a patient's chief complaint. Most notably we found lower than average quality of care delivered to children presenting with fever and upper respiratory symptoms. Differences in quality of care provided to patients with different medical conditions has been noted previously.[32] The finding that some chief complaints were significantly associated with quality of care is consistent with this previous literature and could be explained in part, by differences in the availability of standardized treatment protocols and clinical pathways for various pediatric conditions. The lack of standardized treatment protocols and/or the lack of adoption of these treatment pathways might lead to greater variability in diagnostic evaluations and treatments of children with chief complaints such as fever and upper respiratory symptoms. This rationale is supported by previous studies showing improved healthcare delivery and outcomes based on adherence to treatment protocols and evidence-based pathways.[33-35] In addition, other non-clinical factors that may not have been documented in the medical record, such as parental preferences, may have influenced the emergency department physician's medical decision making, which could have impacted the reviewer's quality of care scores for certain conditions.[5,23]

Our finding that physician-directed quality of care was not associated with a patient's race/ethnicity and insurance status in the multivariable analysis is consistent with some literature in emergency medicine that has found fewer disparities among these factors for children compared to adult patients.[36] However, other literature in emergency medicine has found significant differences in care processes between children based on their race/ethnicity, particularly around the administration of analgesia and imaging in injury.[5,6,23,25,37] These persistent differences document the continued need for efforts to reduce these disparities among children based upon their gender, insurance status and race/ethnicity.

Our study has several limitations. First, the instrument used to measure quality of care focuses on physician-led decision making which may not capture other differences in the quality related to processes of care. For example, there may be differences in patient wait times, patient/family satisfaction of care, quality of nursing care, and other non-physician directed aspects of care quality. Furthermore, it is difficult to relate the magnitude of the differences observed in the quality of care scores to differences in clinical quality and outcomes. The implicit review instrument we used does not consider measures of final discharge diagnoses and ultimate patient outcomes, such as whether or not the patients' conditions improved after

treatment. While our instrument was shown to correlate well with condition-specific, criterion based explicit measures of care, it is difficult to quantify these differences or to correlate them with more familiar measures of quality. In addition, the quality of care scores estimated by the implicit review instrument are based on retrospective review of medical records and not all patient level factors were blinded (e.g., age, sex, race/ethnicity and payment source); therefore, reviews were limited by the completeness and accuracy of the source documents, and potential reviewer implicit biases may have affected reviewers' perceptions of quality of care. While our sample was derived from children treated at 12 children's hospital EDs across the country, it may not accurately reflect the patient population and/or physician-directed quality of care for children receiving treatment at non-children's hospitals, including community and critical access hospitals. For example, our sample included a relatively high number of encounters with a chief complaint of trauma, asthma and seizures and the overall sample had relatively high mean summary quality of care scores likely as a result of our only including PECARN EDs. Because of this, we recommend future studies include patients treated at non-PECARN EDs. Finally, because we used the chief complaint to categorize the patient's clinical condition, the final discharge diagnosis could have been different than the chief complaints, and could have affected our results.

While our study has limitations, it also has strengths. First, we used a previously validated implicit review instrument that is widely applicable to a variety of conditions in the ED as compared to disease-specific measures. The peer review process used in implicit review ensures that quality of care is evaluated using the most current knowledge of physicians and is considered a robust means of grading processes and quality of care, in aggregate. Of note, implicit review instruments are typically used for research and administrative evaluations rather than for evaluating individual clinical assessments or for disseminating quality data to the public. Last, we evaluated the medical records of children presenting to 12 children's hospital EDs across the country and included the implicit review evaluations from eight different pediatric emergency medicine physicians from eight different institutions.

In conclusion, we did not find specific patient-level demographic factors, including age, sex, race/ethnicity and insurance status, to be associated with the physician-directed quality of care delivered to a large cohort of pediatric patients presenting to 12 children's hospital EDs. We did find, however, that a patient's chief complaint was associated with the quality of care

delivered, possibly reflecting lack of availability and/or the variable adherence to evidence-based treatment guidelines. Further research is warranted on the mechanisms by which chief complaints affect the process of care delivery. Disparities in quality can then be addressed with interventions that could lead to more effective, safe, efficient, timely, equitable, and patient centered care. Identification of patient-level factors that impact quality of care will assist health policy makers to generate specific policy recommendations with regard to training, staffing and practice guidelines.

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Table 1. Association of Mean Summary Quality of Care Scores with Patient-Level Factors

Patient Characteristics (N=620)	N (%)	Mean Summary Quality of Care Scores (SD)	P
Age Category			
0 to <2 years	241 (38.9)	30.5 (2.2)	
≥2 to <8 years	225 (36.3)	30.7 (2.1)	0.49
≥8 years	153 (24.7)	30.7 (2.3)	
Gender			
Female	276 (44.6)	30.4 (2.3)	0.02
Male	343 (55.4)	30.8 (2.0)	
Race/Ethnicity			
Hispanic	159 (25.7)	30.5 (2.0)	
White, Non-Hispanic or Latino	203 (32.8)	31.0 (2.1)	0.002[1]
Black, Non-Hispanic or Latino	175 (28.3)	30.2 (2.3)	
Other	82 (13.2)	30.9 (2.2)	
Primary Payment Source			
Public Insurance	384 (62.0)	30.4 (2.1)	<0.001[2]
Private Insurance	204 (33.0)	31.1 (2.1)	
Uninsured	31 (5.0)	29.9 (2.5)	
Triage Category			
Non-Urgent	38 (6.1)	29.8 (2.6)	
Urgent	437 (70.6)	30.6 (2.2)	0.04[3]
Emergent	144 (23.3)	30.8 (1.9)	
Chief Complaint Category			
Trauma	135 (21.8)	31.2 (2.3)	
Abdominal Pain	26 (4.2)	29.6 (2.0)	<0.001[4]
Asthma/Wheezing	76 (12.3)	30.9 (1.8)	
Seizures/Neurological issues	60 (9.7)	30.2 (2.3)	

Upper Respiratory Symptoms	69 (11.1)	30.2 (2.3)
Gastroenteritis	70 (11.3)	30.5 (2.0)
Fever	86 (13.9)	30.2 (1.8)
Other	97 (15.7)	30.8 (2.3)

Table 1, contd. Association of Mean Summary Quality of Care Scores with Patient-Level Factors

Patient Characteristics (N=620)	**N (%)**	**Mean Summary Quality of Care Scores (SD)**	**P**
Time of Presentation to ED			
Daytime	311 (50.2)	30.6 (2.2)	0.52
Nighttime	308 (49.8)	30.7 (2.2)	
Day of Presentation			
Weekday	458 (74.0)	30.7 (2.2)	0.23
Weekend	161 (26.0)	30.4 (2.2)	
PRISA II Score			
-2 to 0	251 (40.5)	30.6 (2.1)	
0 to 6	185 (29.9)	30.7 (2.3)	0.59
6 to 40	183 (29.9)	30.5 (2.1)	
RePEAT Score			
0.250 to 0.977	212 (34.2)	30.6 (2.4)	
0.977 to 1.307	200 (32.3)	30.5 (2.2)	0.48
1.307 to 2.621	207 (33.4)	30.8 (1.9)	
Disposition			
Discharged home	527 (85.1)	30.5 (2.2)	
Admitted to observation unit	11 (1.8)	31.0 (2.6)	0.001[5]
Admitted/Transferred	81 (13.1)	31.4 (1.7)	

[1] Mean Summary Quality of Care scores were significantly higher for White, Non-Hispanic or Latino compared to Black, Non-Hispanic or Latino

[2] Mean Summary Quality of Care scores were significantly higher for Private insurance compared to Public Insurance and Uninsured

[3] Mean Summary Quality of Care scores were significantly higher for Urgent and Emergent compared to Non-Urgent

[4] Mean Summary Quality of Care scores were significantly higher for Trauma compared to Upper Respiratory Symptoms, Fever, and Abdominal Pain.

[5] Mean Summary Quality of Care scores were significantly higher for Admitted/Transferred compared to Discharged home

Table 2. Multivariable Analysis Examining Association Between the Mean Summary Quality of care Scores with Patient-Level Factors

Patient Characteristic		Estimate	95% CI		P
Age (years)		0.01	-0.02	0.04	0.53
Sex	Female	-0.31	-0.63	0.01	0.05
	Male	REF			
Race/Ethnicity	Black, Non-Hispanic	0.02	-0.45	0.50	0.97
	Hispanic	-0.06	-0.55	0.43	
	Other	0.07	-0.46	0.61	
	White, Non-Hispanic	REF			
Payment type	Public insurance	-0.23	-0.62	0.16	0.21
	Uninsured	-0.70	-1.53	0.14	
	Private insurance	REF			
Triage	Emergent/Critical	0.16	-0.60	0.93	0.91
	Urgent	0.15	-0.54	0.84	
	Non-urgent	REF			
Chief Complaint	Abdominal pain	-0.85	-1.73	0.02	<0.01
Category	Asthma or wheezing	0.08	-0.52	0.69	
	Fever*	-0.65	-1.24	-0.06	
	Gastroenteritis	-0.25	-0.87	0.38	
	Seizures/neurological symptoms	-0.45	-1.10	0.20	
	Trauma	0.41	-0.11	0.93	
	Upper respiratory symptoms*	-0.68	-1.30	-0.07	
	Other	REF			

*P<0.05

Figure 1: Structured, Implicit Review Quality of Care Instrument

	Extremely inappropriate	Very inappropriate	Somewhat inappropriate	Intermediate	Somewhat appropriate	Very appropriate	Extremely appropriate
Initial data gathering by physician about acute problems.	1	2	3	4	5	6	7
Physician's integration of information and development of appropriate diagnoses.	1	2	3	4	5	6	7
Physician's initial treatment plan and initial orders.	1	2	3	4	5	6	7
Physician's plan for disposition and follow-up.	1	2	3	4	5	6	7
Assess the overall quality of care provided to the patient.	1	2	3	4	5	6	7