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Parent-Reported Errors and Adverse Events in Hospitalized Children

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Abstract

IMPORTANCE—Limited data exist regarding the incidence and nature of patient- and family-reported medical errors, particularly in pediatrics.

OBJECTIVE—To determine the frequency with which parents experience patient safety incidents and the proportion of reported incidents that meet standard definitions of medical errors and preventable adverse events (AEs).

DESIGN, SETTING, AND PARTICIPANTS—We conducted a prospective cohort study from May 2013 to October 2014 within 2 general pediatric units at a children's hospital. Included in the study were English-speaking parents (N = 471) of randomly selected inpatients (ages 0–17 years) prior to discharge. Parents reported via written survey whether their child experienced any safety incidents during hospitalization. Two physician reviewers classified incidents as medical errors, other quality issues, or exclusions (κ = 0.64; agreement = 78%). They then categorized medical errors as harmful (ie, preventable AEs) or nonharmful (κ = 0.77; agreement = 89%). We analyzed

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errors/AEs using descriptive statistics and explored predictors of parent-reported errors using bivariate statistics. We subsequently reviewed patient medical records to determine the number of parent-reported errors that were present in the medical record. We obtained demographic/clinical data from hospital administrative records.

MAIN OUTCOMES AND MEASURES—Medical errors and preventable AEs.

RESULTS—The mean (SD) age of the 383 parents surveyed was 36.6 (8.9) years; most respondents (n = 266) were female. Of 383 parents surveyed (81%response rate), 34 parents (8.9%) reported 37 safety incidents. Among these, 62%(n = 23, 6.0 per 100 admissions) were determined to be medical errors on physician review, 24%(n = 9) were determined to be other quality problems, and 14%(n = 5) were determined to be neither. Thirty percent (n = 7, 1.8 per 100 admissions) of medical errors caused harm (ie, were preventable AEs). On bivariate analysis, children with medical errors appeared to have longer lengths of stay (median [interquartile range], 2.9 days [2.2–6.9] vs 2.5 days [1.9–4.1]; $P = .04$), more often had a metabolic (14.3%vs 3.0%; $P = .04$) or neuromuscular (14.3%vs 3.6%; $P = .05$) condition, and more often had an annual household income greater than $100 000 (38.1%vs 30.1%; $P = .06$) than those without errors. Fifty-seven percent (n = 13) of parent-reported medical errors were also identified on subsequent medical record review.

CONCLUSIONS AND RELEVANCE—Parents frequently reported errors and preventable AEs, many of which were not otherwise documented in the medical record. Families are an underused source of data about errors, particularly preventable AEs. Hospitals may wish to consider incorporating family reports into routine safety surveillance systems.

In 1999, the Institute of Medicine estimated that between 44000 and 98000 patients die every year in the United States as a result of medical errors.[1] Recent reports suggest that true numbers may be even higher,[2] with as many as 400000 deaths and millions of injuries per year due to harmful errors.[3]

Medical errors are mistakes in the process of care delivery, ie, acts of commission or omission that lead to or have significant potential for an undesirable outcome.[4] Medical errors that cause harm are also known as preventable adverse events (AEs).[4] While most errors do not cause harm, studying even nonharmful medical errors can provide important insights into error and harmprevention.[5] This is particularly true in pediatrics, as hospitalized children experience rates of medical errors similar to those of adults but may experience potentially harmful errors more frequently.[6]

Error and AE detection methods have greatly advanced over the past few decades.[7–10] Medical record review–based surveillance methods using trigger tools detect errors and AEs at more than 10 times the rates of traditional incident-reporting systems or systems based on reviews of hospital administrative records.[9–15] While error and AE detection methods have progressed, patient and family reports remain notably absent from most surveillance systems.

Patients and families have the potential to play an important role in identifying medical errors and AEs. In one study, 23% of respondents reported that they or someone close to them had experienced a medical error in the past 5 years.[16] Another study found that 20% of

patients reported experiencing verified medical errors.[17] A few adult studies have found that patients identify numerous verified errors and AEs not otherwise documented in the medical record.[18–20] Pediatric data on patient and family involvement in error and AE detection are limited[21–24] but similarly suggest that families often report verified errors and AEs that are not detected through other sources.[23]

Given the family's central role in pediatrics, parent-reported errors may be a fruitful source of error and AE surveillance for hospitalized children and may provide lessons regarding the utility of family error reporting in other populations. Therefore, we examined the rates and predictors of parent-reported errors and AEs in a cohort of hospitalized children.

Methods

Data, Setting, and Study Population

We conducted a prospective cohort study of parent-reported medical errors involving parents of children (aged 0–17 years) hospitalized in 2 general pediatric units at a tertiary care children's hospital between May 2013 and October 2014, concurrent with data collection for a study on nighttime communication.[25] We included parents of nonsurgical patients covered by general pediatric, short-stay (patients with straightforward illnesses), and subspecialty (eg, adolescent) teams. We administered written surveys on Monday through Thursday evenings to parents of a randomly selected subset of children anticipating discharge within 24 hours. We collected responses that same evening or, if requested by the parent, the following morning. We asked parents to report whether their child experienced a mistake (ie, an error), any negative effects from the mistake (ie, a harmful error, also known as a preventable AE), and details of the incident. We did not ask parents about no preventable AEs (ie, harms not resulting from errors). We collected self-reported parent demographic data and hospital administrative record–based patient clinical/ demographic data. We obtained verbal consent from parents for participation in the study using an information sheet. The Boston Children's Hospital Institutional Review Board approved the study.

Key Points

Question

How often do parents of hospitalized children report safety incidents, and what is the proportion of these that meet standard definitions of medical errors and preventable adverse events?

Findings

In this cohort study, 8.9%of parents reported that their child experienced safety incidents. Most were deemed medical errors on physician review, and many were not otherwise documented in the medical record.

Meaning

Parents may be a valuable and complementary source of data about hospital safety incidents, particularly preventable adverse events.

Exclusions

Given limited interpreter resources, we included only English-speaking parents. We excluded parents of patients spending fewer than 2 nights in the unit, "boarding" on the unit awaiting inpatient psychiatric placement, in state custody, or 18 years of age or older at admission.

Error Validation and Classification

Two physicians with training in error surveillance and experience conducting such reviews independently reviewed all parent-reported safety concerns. They came to consensus about whether each represented a medical error, a nonsafety-related quality issue, or neither (κ = 0.64; agreement = 78%) and classified errors as harmful or nonharmful (ie, near-misses or errors with little potential for harm; κ = 0.77; agreement = 89%).

We later reviewed patient medical records to determine the number of parent-reported errors that were documented in the medical record. We also separately analyzed and categorized parent concerns by type of error or nonsafety-related quality issue.

Outcome and Predictors

Our primary outcome was physician-validated, parent-reported errors. We evaluated the distribution of parent-reported medical errors by parent and patient age, sex, and race/ethnicity; parent education, income, and primary language; and patient insurance, length of stay, and complex chronic condition (CCC) count and category. A marker of medical complexity, CCCs use *International Classification of Diseases, Ninth Revision, Clinical Modification* codes to identify medical conditions expected to last 12 or more months that involve several organ systems or one organ system severely enough to require specialty pediatric care and hospitalization at a tertiary care center.[26] Age and length of stay remained continuous predictors, while all other variables were categorized as presented in Table 1 for analysis.

Statistical Analyses

We used descriptive statistics to report rates of parent-reported errors and preventable AEs. We used percentages for categorical variables and means (with SDs) for continuous variables. We performed a descriptive analysis to compare parent and patient characteristics for cases in which a parent reported a medical error vs cases in which a parent did not report a medical error. To identify factors associated with parent-reported medical errors, we dichotomized the sample into cases with 1 or more parent-reported medical errors and cases with no reported medical errors. To explore bivariate associations between sociodemographic and clinical factors across the 2 groups, we used the Wilcoxon-Mann-Whitney U test for differences in average age (for parents and patients) and the χ^2 and Fisher exact tests to assess differences in remaining categorical variables. A P value less than .05 was considered statistically significant for all analyses.

We additionally performed a content analysis with clustering according to theme on text from the open-ended question asking parents to explain the type of mistake or harm their

child experienced. Study data were collected and managed using REDCap (Vanderbilt University).[27] Statistical analyses were performed using SAS version 9.4 (SAS Institute).

Results

Sample Characteristics

Overall, 98.9%(N = 471) of eligible parents consented to participate in the study. Of these, 383 parents provided responses about whether their child experienced an error or preventable AE (81.3% response rate).

On average, parent respondents were approximately 37 years old and predominantly female, white, non-Hispanic, primarily English speaking, and college educated, with an annual household income of $50000 or more (Table 1). Patients were on average 6 years old and predominantly nonpublically insured, male, with no CCCs, and a median length of stay of 2.6 days (Table 1).

Rates, Types, and Predictors of Parent-Reported Errors

In total, 34 parents (8.9%) reported 37 safety concerns during their child's hospitalization. Of these concerns, 62.2%(n = 23, 6.0 per 100 admissions) were determined to be medical errors on physician review (Figure) and 24.3% (n = 9) were deemed nonsafety-related quality issues. The remaining concerns (n = 5, 13.5%) were excluded because there was either no clear error or nonsafety-related quality issue or insufficient information.

Overall, 57%(n = 13) of parent-reported medical errors were also identified on subsequent medical record review, including 2 cases where the medical record indicated that staff would file an incident report in the hospital's voluntary safety reporting system. There was no documentation in the medical record of 43% (n = 10) of parent-reported errors.

Of medical errors, 30.4% (n = 7, 1.8 per 100 admissions) were deemed harmful (ie, preventable AEs). Errors and preventable AEs reported by parents were related to diagnosis, medication, procedure, and other therapy/care. Harmful errors appeared most often to be procedure- or diagnosis-related errors, while nonharmful errors/near-misses appeared to be predominantly medication related (Table 2).

In unadjusted bivariate analysis, characteristics associated with a higher likelihood of reporting a medical error included longer length of stay and presence of a metabolic CCC (Table 1). Compared with children whose parents did not report medical errors, children whose parents reported medical errors had a median (interquartile range) length of stay of 2.9 days (2.2–6.9) vs 2.5 days (1.9–4.1) ($P = .04$); a metabolic CCC in 14.3% vs 3.0% of cases ($P = .04$); a neuromuscular CCC in 14.3% vs 3.6% of cases ($P = .05$); and an annual household income greater than $100 000 in 38.1% vs 30.1% of cases ($P = .06$).

Narrative Comments

Narrative comments (n = 33) provided by parents in response to the open-ended item asking them to explain the type of mistake or harm their child experienced revealed a spectrum of errors and nonsafety-related quality concerns (Table 2). Preventable AEs included delays in

diagnosis of a foreign body, recognition and treatment of urinary retention, and receipt of pain medication; an intravenous infiltrate; an infection caused by a prolonged unused intravenous catheter; a staff needle-stick injury requiring the child to have additional blood drawn for testing; and an inadequately dressed wound that became saturated with stool. Nonharmful errors included reading a magnetic resonance image incorrectly, informing parents about a procedure intended for another patient, pinning the wrong limb of a patient down, documenting weight measurements incorrectly, failing to unclamp a catheter, feeding a patient with the bottle of a sibling with thrush, and giving salty crackers to a patient on a salt-restricted diet. Nonharmful medication-related incidents/near-misses included errors in medication timing (given too early or too late), dosing (double the dose given, child accidentally administered the dose, and dose omitted), and type (wrong intravenous fluids and wrong medication documented in medical record).

Parents identified communication problems as contributing factors in a number of errors. These included communication between health care professionals (eg, day and night teams failed to communicate a change in insulin rate), communication between health care professionals and parents (eg, parent had to request someone 5 times), and written communication in the medical record (eg, procedure was filed under the wrong patient).

Nonsafety-related quality issues included issues with care delivery, hospital environment, communication, experience, and interpersonal interactions. Excluded incidents included 2 cases involving expected procedural occurrences (blood in a spinal fluid sample and repeated attempts at a blood draw) and 1 involving diagnostic uncertainty.

Discussion

We found that 1 in 11 families among a sample of 471 families in a large children's hospital reported that their child experienced a mistake during hospitalization. Most of these events were validated as medical errors on physician review, yielding a medical error rate of 6.0 per 100 admissions and a preventable AE rate of 1.8 per 100 admissions. Bivariate predictors of parent-reported errors included length of stay and presence of certain chronic conditions.

Our finding that approximately 60% of parent-reported safety concerns were validated on physician review is similar to adult studies, which have found that 20% to 71% of patient-reported incidents were confirmed on physician review to be safety events.[19,20] Our error and preventable AE rates were lower than patient-reported AE rates found in 2 adult studies, which detected AEs in 23% of patients[18] and 8.8 per 100 admissions,[20] respectively, and are likewise lower than a Canadian pediatric study that found 28.1 errors and AEs per 100 admissions.[23] It is unclear whether differences in reported rates are due to differences in data collection methods, patient populations, or true differences in AE and error rates across institutions.

When examining predictors of parent-reported errors, length of stay and the presence of certain CCCs were associated with higher rates of error. Longer length of stay has previously been found to be associated with an increased likelihood of experiencing a medical error,[28] likely owing to both increased exposure to the risk of an error and because

patients who experience AEs may consequently have prolonged lengths of stay. Children with certain CCCs may be more likely to experience errors owing to the number and complexity of interventions they experience. In addition, parents of children with chronic conditions may be more familiar with the health care system and therefore more comfortable reporting an error. Further research is needed to examine the interplay of the myriad factors that could affect error reporting by parents.

We found that more than half of parent-reported errors were also documented in the patient's medical record. This figure is similar to studies of patient and parent error reporting, which found evidence of between 5% and 55% of parent-reported AEs and safety incidents in the medical record.[18,20]

While our study did not directly compare rates of family-reported errors with those detected through systematic surveillance, a recent study we conducted in the same units using a systematic active surveillance methodology identified 1.5 preventable AEs per 100 admissions,[29] similar to the rate of 1.8 preventable AEs per 100 admissions we identified in the current study. Although the total rate of parent-reported errors in the current study was about one-third of that detected using systematic active error surveillance in our prior study, the preventable AE rate was comparable in both studies. This suggests that while parent reports may be a less sensitive means of detecting nonharmful errors—perhaps because these errors are often not discussed with or witnessed by parents or because these errors require more sophisticated medical knowledge to identify—parents may be more reliable reporters of harmful errors.

As systematic medical record surveillance methods have progressed, they have become more sensitive and reliable, detecting AEs at 10-fold higher rates than administrative screening tools and voluntary hospital reporting systems.[2,7,9–15] However, patient and family reports have remained notably underused as a means of detecting errors and harms. Our study suggests that while parents may not be aware of most errors that occur and may often report incidents that are nonsafety-related quality issues rather than errors, parents appear to provide complementary information that allows a richer understanding of safety events.

Additionally, even parent concerns that are not strictly safety related may provide useful information that can improve the quality and safety of care provided. The discrepancy between what parents and physicians deemed medical errors and AEs might relate to different thresholds of reporting, priorities, definitions, and medical knowledge, among other factors. Regardless, these results suggest that further communication between parents and physicians and nurses around safety may be beneficial.

Ultimately, while family error reporting should not replace active surveillance, hospitals may wish to consider more actively involving families in the surveillance process. Family members can be crucial partners not only in reporting but also in ensuring the safety of hospitalized patients. Parents are frequently at their child's bedside and are typically actively engaged in their child's care, both inside and outside the hospital. At home, they are often responsible for administering medications and typically have intimate knowledge of their child's doses and allergies. A parent who notices a nurse drawing up a larger volume of a

medication than the child receives at home, for instance, may be able to intercept a potential overdose.

However, in order for parents to be effective partners in error and harm prevention, they need to be well-informed about care plans, kept up-to-date as changes are made, and encouraged to participate and speak up. One approach is to instruct all parents on how to report potential errors; the inclusion of an item asking parents whether they were informed of the hospital's error-reporting process in the Child Hospital Consumer Assessment of Healthcare Providers and Systems survey[30] may prompt more hospitals to systematically provide such information to all families. By priming parents to pay attention to safety, hospitals may be able to engage them to help identify errors and perhaps even mitigate those that are potentially harmful.

Prior research has shown that patients are interested in engaging more in safety efforts[31–33] and that physicians, nurses, and other health care professionals support increasing such patient involvement.[31,32] However, interpersonal, intrapersonal, and cultural barriers to patient involvement in safety initiatives exist.[34] For instance, patients appear to be less comfortable with safety efforts that require them to engage in what they perceive as challenging behaviors (eg, notifying physicians/nurses of errors) and conversely more comfortable with efforts that involve non challenging behaviors (eg, reporting an error to a reporting system).[35] These differences may result from parent perceptions of hierarchy and power differentials in the medical system, as well as other factors, but must be considered when designing safety interventions involving patients and families. Involvement in a nonchallenging system, such as the one we established in our study, may provide a means to actively involve parents in safety promotion without placing them in a position where they feel compelled to interact in a confrontational manner with the health care professionals caring for their child.

Communication failures are a leading cause of sentinel events,[1] and communication is known to affect safety.[36,37] Interestingly, the families in our study seemed to recognize the link between communication and safety, as many explicitly mentioned communication failures as a contributing factor to their reported safety incidents. Strategies to improve miscommunications among physicians have been shown to decrease errors and AEs.[29,38–40] The effect on patient safety of improving communication between health care professionals and families is an unexplored area ripe for future research.

Our study had a number of limitations. It was a single center study conducted in a tertiary care pediatric hospital on predominantly female, well-educated, higher-income parents of children admitted for 2 or more nights. All of these factors limit generalizability. Additionally, we were not able to capture error and AE rates for children of non-English–speaking parents. Such children may be particularly prone to errors,[41] making parent-reported error and AE rates potentially even higher than those we detected. Moreover, we did not ask parents about nonpreventable AEs, so our AE rate does not capture this subset of AEs. Validation of errors and AEs is not a precise science, although we had 2 physician reviewers reach consensus and subsequently reviewed patient medical records for additional information. Finally, although our study suggested some direction for future inquiry, we

lacked the statistical power to do a robust analysis of predictors of parent-reported errors. These are all areas of future study.

Conclusions

Parents appear to be a valuable but underused source of data about hospital safety incidents, particularly preventable AEs. Parent-reported preventable AE rates may be similar to those detected through medical record review–based active surveillance methods. Hospitals may wish to consider partnering more actively with patients and families in their efforts to detect errors and improve the safety and quality of care.

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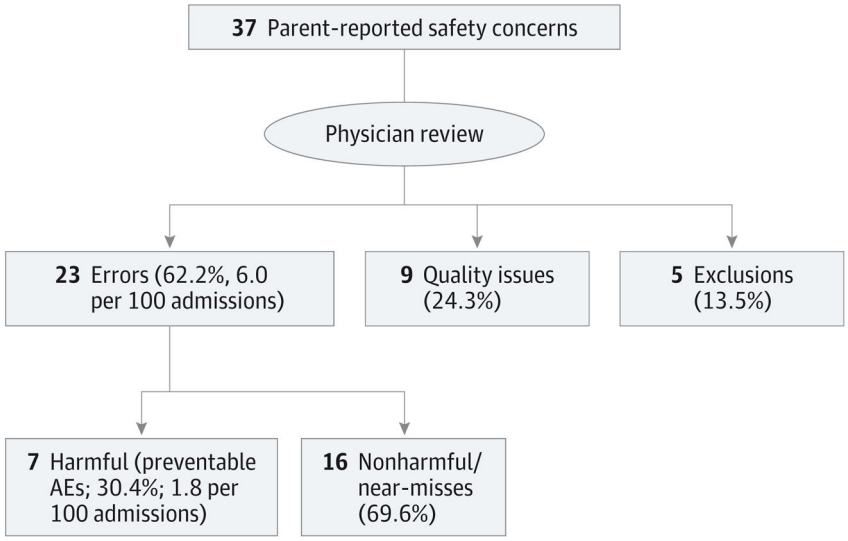

Figure. Classification of Parent-Reported Safety Concerns

Thirty-four parents reported 37 safety concerns that occurred during their child's hospitalization. Physician reviewers classified these concerns as errors, including harmful errors (ie, preventable adverse events [AEs]) and nonharmful errors/near-misses, as nonsafety-related quality issues, or as exclusions.

Table 1

Parent-Reported Errors by Parent and Patient Characteristics

Characteristic	No. (%)			*P* Value
		Reported Errors		
	Overall (n = 383)	None (n = 362)	≥1 (n = 21)	
Parent Characteristics[a]				
Age, mean (SD), y	36.6 (8.9)	36.6 (8.8)	36.8 (11.8)	.92
Sex				
Male	59 (15.4)	56 (15.5)	3 (14.3)	.94
Female	266 (69.5)	250 (69.1)	16 (76.2)	
Missing	58 (15.1)	56 (15.5)	2 (9.5)	
Relationship to patient				
Parent	315 (82.3)	298 (82.3)	17 (81.0)	.20
Other	12 (3.1)	10 (2.8)	2 (9.5)	
Missing	56 (14.6)	54 (14.9)	2 (9.5)	
Race/ethnicity				
Non-Hispanic				
White	201 (52.5)	184 (50.8)	17 (81.0)	.30
Black	32 (8.4)	32 (8.8)	0 (0.0)	
Asian	14 (3.7)	14 (3.9)	0 (0.0)	
Other	16 (4.2)	16 (4.4)	0 (0.0)	
Hispanic	61 (15.9)	59 (16.3)	2 (9.5)	
Missing	59 (15.4)	57 (15.7)	2 (9.5)	
Primary language				
English	323 (84.3)	307 (84.8)	16 (76.2)	.29
Other	60 (15.7)	55 (15.2)	5 (23.8)	
Education				
Less than high school	16 (4.2)	15 (4.1)	1 (4.8)	.96
High school	48 (12.5)	46 (12.7)	2 (9.5)	
Some college	175 (45.7)	164 (45.3)	11 (52.4)	
≥4 y of college	82 (21.4)	78 (21.5)	4 (19.0)	
Missing	62 (16.2)	59 (16.3)	3 (14.3)	
Annual household income, $				
<30 000	81 (21.2)	77 (21.3)	4 (19.0)	.06
30 000–49 999	37 (9.7)	37 (10.2)	0 (0.0)	
50 000–74 999	27 (7.1)	22 (6.1)	5 (23.8)	
75 000–99 999	27 (7.1)	26 (7.2)	1 (4.8)	
≥100 000	117 (30.6)	109 (30.1)	8 (38.1)	
Missing	94 (24.5)	91 (25.1)	3 (14.3)	

Characteristic	No. (%)			*P* Value
		Reported Errors		
	Overall (n = 383)	None (n = 362)	≥1 (n = 21)	
Patient Characteristics[b]				
Age, mean (SD), y	6.0 (5.7)	6.1 (5.7)	4.2 (4.9)	.15
Age, y				
<1	112 (29.2)	104 (28.7)	8 (38.1)	.39
1–5	111 (29.0)	103 (28.5)	8 (38.1)	
6–13	108 (28.2)	105 (29.0)	3 (14.3)	
14–17	52 (13.6)	50 (13.8)	2 (9.5)	
Sex				
Male	194 (50.7)	182 (50.3)	12 (57.1)	.54
Female	189 (49.4)	180 (49.7)	9 (42.9)	
CCC count[c]				
0	283 (73.9)	269 (74.3)	14 (66.7)	.08
1	75 (19.6)	72 (19.9)	3 (14.3)	
≥2	25 (6.5)	21 (5.8)	4 (19.0)	
CCC category[c]				
Neuromuscular	16 (4.2)	13 (3.6)	3 (14.3)	.05
Cardiovascular	34 (8.9)	33 (9.1)	1 (4.8)	>.99
Respiratory	7 (1.8)	7 (1.9)	0 (0.0)	>.99
Renal	11 (2.9)	11 (3.0)	0 (0.0)	>.99
Gastrointestinal	8 (2.1)	8 (2.2)	0 (0.0)	>.99
Hematologic/immunologic	24 (6.3)	22 (6.1)	2 (9.5)	.63
Metabolic	14 (3.7)	11 (3.0)	3 (14.3)	.04[d]
Malignancy	7 (1.8)	7 (1.9)	0 (0.0)	>.99
Other	13 (3.4)	11 (3.0)	2 (9.5)	.16
Length of stay, median (IQR)	2.6 (1.9–4.1)	2.5 (1.9–4.1)	2.9 (2.2–6.9)	.04[d]
Insurance				
Nonpublic	233 (61.3)	221 (61.6)	12 (57.1)	.69
Public	147 (38.7)	138 (38.4)	9 (42.9)	

Abbreviations: CCC, complex chronic condition; IQR, interquartile range.

[a] Based on survey response data.

[b] Based on hospital administrative data.

[c] CCCs use *International Classification of Diseases, Ninth Revision, Clinical Modification* codes to identify medical conditions expected to last 12 or more months and involve several organ systems or 1 organ system severely enough to require specialty pediatric care and hospitalization at a tertiary care center.[26]

[d] Statistically significant.

Table 2

Categories of 32 Parent-Reported Errors and Other Quality Issues

Category[a]	No. (%)
Harmful errors (n = 7)	
Procedure related	3 (43)
Diagnosis related	2 (29)
Medication related	1 (14)
Other therapy/care related	1 (14)
Nonharmful errors/near-misses (n = 16)	
Procedure related	3 (19)
Diagnosis related	2 (12)
Medication related	8 (50)
Other therapy/care related	3 (19)
Nonsafety-related quality issues (n = 9)	
Care delivery	3 (33)
Communication	2 (22)
Environment	2 (22)
Interpersonal	1 (11)
Experience	1 (11)

[a]Categories of parent-reported concerns that, on physician review, were confirmed to be errors (harmful errors [ie, preventable adverse events] or nonharmful errors/near-misses) or nonsafety-related quality issues. Percentages may not add up to 100 owing to rounding.