Medical Errors in US Pediatric Inpatients With Chronic Conditions

WHAT’S KNOWN ON THIS SUBJECT: Iatrogenic medical errors are an important medical care issue in the United States. Errors may be particularly important in children with chronic health conditions, especially as the prevalence of chronic conditions is increasing in children.

WHAT THIS STUDY ADDS: In a nationally representative sample, we found that pediatric inpatients with chronic conditions were at a significantly higher risk for medical errors than inpatient children without chronic conditions, controlling for severity of illness, length of stay, and other potential confounders.

abstract

OBJECTIVE: To investigate the association between chronic conditions and iatrogenic medical errors in US pediatric inpatients.

METHODS: The 2006 Kids’ Inpatient Database (KID) was analyzed. Medical errors were defined by using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. Medical error rates per 100 hospital discharges and per 1000 inpatient days were calculated. Logistic regression models were fitted to study the association between number of chronic conditions and medical errors, controlling for patient characteristics, hospital characteristics, disease severity, and length of stay.

RESULTS: In the 2006 KID, 22.3% of pediatric inpatients had 1 chronic condition, 9.8% had 2 chronic conditions, and 12.0% had ≥3 chronic conditions. The overall medical error rate per 100 discharges was 3.0 (95% confidence interval [CI]: 2.8–3.3); it was 5.3 (95% CI: 4.9–5.7) in children with chronic conditions and 1.3 (95% CI: 1.2–1.3) in children without chronic conditions. The medical error rate per 1000 inpatient days was also higher in children with chronic conditions. The association between chronic conditions and medical errors remained statistically significant in logistic regression models adjusting for patient characteristics, hospital characteristics, disease severity, and length of stay. In the adjusted model, the odds ratio of medical errors for children with 1 chronic condition was 1.40 (95% CI: 1.32–1.48); for children with 2 conditions, the OR was 1.55 (95% CI: 1.45–1.66); and for children with 3 conditions, the OR was 1.66 (95% CI: 1.53–1.81).

CONCLUSIONS: The number of chronic conditions was significantly associated with iatrogenic medical errors in pediatric inpatients. Pediatrics 2012;130:e786–e793

AUTHORS: Namrata Ahuja, MD,a,b,c Weiyan Zhao, MD, PhD,a and Huiyun Xiang, MD, MPH, PhD,a,b

aThe Ohio State University College of Medicine, Columbus, Ohio; bCenter for Injury Research and Policy, The Research Institute at Nationwide Children’s Hospital, Columbus, Ohio; and cIndiana University School of Medicine, Indianapolis, Indiana

KEY WORDS children, chronic condition, medical errors, medical injuries

ABBREVIATIONS AHRQ—Agency for Healthcare Research and Quality
APR—All Patient Refined Diagnosis Related Groups
CI—confidence interval
HCUP—Healthcare Cost and Utilization Project
ICD-9-CM—International Classification of Diseases, Ninth Revision, Clinical Modification
KID—Kids’ Inpatient Database
LOS—length of stay
OR—odds ratio

Each of the authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; participated in drafting the article or revising it critically for important intellectual content; and gave final approval of the version to be published.

The views expressed here are solely the responsibility of the authors and do not necessarily reflect the official views of the Centers for Disease Control and Prevention.

www.pediatrics.org/cgi/doi/10.1542/peds.2011-2555
doi:10.1542/peds.2011-2555
Accepted for publication May 18, 2012
Address correspondence to: Huiyun Xiang, MD, MPH, PhD, Center for Injury Research and Policy, The Research Institute at Nationwide Children’s Hospital, 700 Children’s Dr, Columbus OH 43205. E-mail: huiyun.xiang@nationwidechildrens.org
PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2012 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Drs Zhao and Xiang were supported by a grant from the National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (grant R49/CE001172-01).
The Institute of Medicine’s report, To Err Is Human: Building a Safer Health System, estimated 44,000 to 98,000 deaths due to medical errors each year in the United States.1 Pediatric patients are not exempt from such iatrogenic events. Two previous studies have examined medical errors during pediatric hospitalization.2,5 Using the Kids’ Inpatient Database (KID) 1988 to 1997, Slonim et al3 first reported national rates of hospital-reported medical errors in hospitalized children. It has been almost a decade since that study was published, and with considerable changes in technology and medicine, an updated study is warranted. More importantly, Slonim et al recommended more in-depth study about medical errors in children with chronic conditions and related special needs because their article focused broadly on all children hospitalized.

There is a scarcity of literature on medical errors in children with chronic conditions, even though the prevalence of chronic conditions has been increasing in the pediatric population in the United States.4 A recent study found that as many as 43% of US children have at least 1 chronic health condition, and almost 20% have ≥2 chronic conditions.5 These patients constitute an increasing proportion of pediatric hospitalization,6,7 and account for the majority of noninjury hospital admissions.8 Because of their frequent encounters with the health care system, children with chronic conditions have been identified as an important high-risk group for medical errors.3,7 Due to complex medicine regimens, children with chronic conditions are susceptible to medication errors at home as well.9 Children with special health care needs have also been identified as susceptible to errors in emergency health care situations.10 However, no comprehensive national studies have investigated the impact of chronic conditions on the number of medical errors in pediatric inpatients. Using a national inpatient database, the first objective of this study was to investigate whether there was an association between chronic conditions and iatrogenic medical errors across different patient and hospital characteristics. The second objective was to evaluate the impact of disease severity and length of stay (LOS) on the association between chronic conditions and medical errors. Understanding the epidemiology of medical errors in those with chronic conditions can help determine if this is a high-risk group that might benefit from more targeted error reduction strategies.

METHODS

Data Source

KID 2006 was used in this study. KID is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ).11 It is the only national data set that has been designed to study children’s use of hospital services, quality of care, outcomes, and associated charges. KID 2006 contains a sample of pediatric discharges from all community, nonrehabilitation hospitals in the 38 states that had agreed to participate in the HCUP. The data set contains >100 clinical and nonclinical variables, including 15 diagnosis codes. Weights and sampling variables are provided for calculating national estimates. KID data were first collected in 1997, and the data set is available every 3 years. The 2006 KID was the most current data set available when the current study was performed and included information from 3.1 million pediatric discharges from 3739 hospitals, representing >7.5 million hospital discharges nationwide. The 2006 KID stratification variables included hospital geographic region (Northeast, Midwest, West, and South), hospital control (public, voluntary, and proprietary), hospital location (urban or rural), hospital teaching status (teaching or nonteaching), hospital bed size (small, medium, and large), and hospital type (freestanding children’s or other hospital).

The 2006 KID included all discharged patients who were aged ≤20 years at admission. To be consistent with the conventional definition of children, all discharges of children aged 0 to 18 years were used for our analyses. Hospital discharges of newborns were excluded in this study because this is predominantly a healthy group and to be consistent with previous work using this data set.3 Because the KID data set contains de-identified data that are available in public domain for research, this study was exempted from the institutional review board approval.

Definition of Medical Error

Using the same approach by Slonim et al,3 this study identified medical errors by using several specific International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes for iatrogenic medical errors. As done in the study by Slonim et al, we included ICD-9-CM codes 996–999 (complications of surgical and medical care) and code 995.2 (unspecified adverse effect of drug, medicinal and biological substance). We searched through all 15 diagnosis codes for each discharge, and any discharge that had at least 1 of these ICD-9-CM codes was defined as a case of hospital-reported medical error. These medical errors are considered iatrogenic medical injuries and may be preventable.

Definition of Chronic Condition

The 2006 KID provides a Chronic Condition Indicator variable to categorize
all ICD-9-CM diagnosis codes as either chronic or not chronic. According to the inclusion criteria in the HCUP data system, a chronic condition is a condition that lasts ≥12 months and meets 1 or both of the following tests: (1) it places limitations on self-care, independent living, and social interactions; and (2) it results in the need for ongoing intervention with medical products, services, and special equipment. All congenital anomalies are considered chronic conditions, and those ICD-9-CM codes that refer to explicitly chronic conditions are considered chronic. Chronic conditions are grouped into 18 categories in the 2006 KID. Greater detail on the development of the Chronic Condition Indicator is available at the HCUP Web site.

Study Variables

The study’s dependent variable was the iatrogenic medical errors reported by the hospital, and the main independent variable of interest was the presence of chronic medical conditions. The association between chronic conditions and iatrogenic medical errors was examined across various patient characteristics, including age, gender, median household income, admission source, disease severity, and LOS. Age was divided into categories of <1 year, 1 to 5 years, 6 to 12 years, and 13 to 18 years. Disease severity was assessed by using 1 of 4 available measures in the KID, the All Patient Refined Diagnosis Related Groups (APR-DRG). LOS was categorized into 0 to 2 days, 3 to 7 days, 8 to 14 days, and ≥15 days.

We also compared rates of medical errors according to hospital characteristics such as region, location (urban versus rural), type (freestanding children’s hospital, children’s unit in a general hospital, or nonchildren’s hospital), bed size, and teaching status.

Statistical Analysis

Data analyses were conducted by using SAS version 9.2 (SAS Institute, Inc, Cary, NC) and SAS-callable SUDAAN version 10 software (Research Triangle Institute, Research Triangle Park, NC).

We first counted the total number of chronic conditions associated with each discharge record, and then calculated the rate of medical errors per 100 hospital discharges and the rate per 1000 inpatient days for patient groups with increasing numbers of chronic conditions. The rate per 1000 inpatient days was used to account for the patients’ exposure time in the hospital. The study hypothesis was that as the number of chronic conditions increased, the rate of iatrogenic errors would also increase. The rates of medical errors per 100 hospital discharges and per 1000 inpatient days were plotted against the number of chronic conditions, and correlation coefficients between the 2 variables were calculated.

Using the weighting variables provided in the KID, national estimates of the different types of iatrogenic medical errors were calculated for inpatient children with and without chronic conditions. We then produced national estimates and calculated the rate of iatrogenic medical errors per 100 discharges according to patient and hospital characteristics. The rates of medical errors were compared for those with and without chronic conditions across both patient and hospital characteristics by using the $\chi^2$ statistic.

Finally, to control for confounding effects of age, gender, race/ethnicity, hospital characteristics, disease severity (APR-DRG), and LOS when the association between number of chronic conditions and iatrogenic medical errors was examined, logistic regression models were fitted by using a step-by-step hierarchical approach so the confounding effect of those variables could be evaluated.

RESULTS

Number of Chronic Conditions and Medical Errors

In the KID data, up to 15 diagnosis codes per patient could be reported. In the 2006 KID inpatient population, the top 10 most frequently reported categories of chronic conditions were: chronic conditions of the respiratory system (12.3%), mental disorders (10.6%), congenital anomalies (9.1%), diseases of the nervous system and sense organs (5.9%), endocrine, nutritional, and metabolic diseases and immunity disorders (5.7%), diseases of the digestive system (4.8%), chronic diseases of blood and blood-forming organs (4.5%), factors influencing health status and contact with health services (4.2%), neoplasms (3.0%), and chronic conditions of the musculoskeletal system (1.6%). The remaining 8 categories of chronic conditions each contained <1%. Figure 1 shows the relationship between the number of chronic conditions and the medical error rates per 100 hospital discharges and per 1000 inpatient days. A strong, positive dose-response relationship was found between number of chronic conditions and the rate of medical errors per 100 hospital discharges ($R^2 = 0.97, \ P < .0001$). As the number of chronic conditions increased from 0 to ≥10, the rate of medical errors per 100 discharges increased from 1.3 (95% confidence interval [CI]: 1.2–1.3) to 15.8 (95% CI: 13.2–18.7). Although there was a relationship between the number of chronic conditions per child, per visit, or per total number and the rate of medical errors per 1000 inpatient days, this relationship leveled off after the total number chronic conditions reached 3 or more. Results from the 2006 KID data indicate that 22.3% (95% CI: 21.9–22.8) of pediatric inpatients had...
1 chronic condition, 9.8% (95% CI: 9.4–10.2) had 2 chronic conditions, and 12.0% (95% CI: 11.3–12.8) had ≥3 chronic conditions (data not shown).

The medical error rate per 100 hospital discharges was 5.3 (95% CI: 4.9–5.7) in children with chronic conditions and 1.3 (95% CI: 1.2–1.3) in children without chronic conditions (P < .001) (Table 1). The overall iatrogenic error rate was 3.0 (95% CI: 2.8–3.3) per 100 hospital discharges. A total of 60,307 pediatric inpatients in the 2006 KID had medical errors, resulting in a national estimate of 100,415 (95% CI: 88,912–111,918) pediatric inpatients with medical errors based on the definition of hospital-reported medical errors in this study. The most frequently reported medical errors in children with chronic conditions were due to “complications peculiar to certain specified procedures” (ICD-9-CM code 996). In those inpatients without chronic conditions the most frequently reported code was ICD-9-CM 998 (other complications of procedures not elsewhere classified).

### Demographic and Hospital Characteristics

The results in Table 2 indicate that the medical error rates per 100 hospital discharges were statistically higher in patients with chronic conditions when compared with the error rates in patients without any chronic conditions across all of the patient variables, including disease severity and LOS (P < .001).

The difference in medical error rates between patients with and without chronic conditions was also statistically significant (P < .001) across all hospital characteristics (Table 3). Among those with chronic conditions, higher rates of medical errors were reported by urban hospitals, teaching hospitals, children’s hospitals, and children’s units in general hospitals than by their counterparts. Further analysis revealed that children treated at these hospitals had more chronic conditions. For example, of those pediatric patients treated at teaching hospitals, 24.6% (95% CI: 24.0–25.2) had 1 chronic condition, 12.1% (95% CI: 11.6–12.7) had 2 chronic conditions, and 15.7% (95% CI: 14.7–16.7) had ≥3 chronic conditions. In contrast, of those pediatric patients treated at nonteaching hospitals, 18.9% (95% CI: 18.3–19.6) had 1 chronic condition, 6.0% (95% CI: 5.6–6.5) had 2 chronic conditions, and 6.0% (95% CI: 5.3–6.8) had ≥3 chronic conditions.

**TABLE 1** MEs Among Pediatric Inpatients With and Without Chronic Conditions, KID 2006

<table>
<thead>
<tr>
<th>ICD-9-CM Code</th>
<th>Description</th>
<th>With Chronic Conditions</th>
<th>Without Chronic Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of MEs</td>
<td>National Estimatea</td>
</tr>
<tr>
<td>---</td>
<td>All inpatient discharges with MEs*</td>
<td>46,022</td>
<td>77,176</td>
</tr>
<tr>
<td>996</td>
<td>Complications peculiar to certain specified procedures</td>
<td>26,133</td>
<td>43,955</td>
</tr>
<tr>
<td>997</td>
<td>Complications affecting specified body system body system</td>
<td>10,141</td>
<td>17,100</td>
</tr>
<tr>
<td>998</td>
<td>Other complications of procedures not elsewhere classified</td>
<td>11,565</td>
<td>19,243</td>
</tr>
<tr>
<td>999</td>
<td>Complications of medical care not elsewhere classified</td>
<td>19,568</td>
<td>32,613</td>
</tr>
<tr>
<td>995.2</td>
<td>Unspecified adverse effect of drug, medicinal, and biological substance</td>
<td>200</td>
<td>329</td>
</tr>
</tbody>
</table>

ME, medical error.

* National estimates of MEs were calculated by using the weighting variables provided in the KID 2006.

b Number of discharges with MEs per 100 hospital discharges.

* The frequency of all discharges with MEs is less than the sum of the individual categories of MEs because some discharges had multiple ICD-9-CM error diagnoses.

*P < .001 from the χ² test of ME rate difference between pediatric inpatients with and without chronic conditions.
Logistic Regression Analysis Results

The odds ratios (ORs) and 95% CIs of medical errors from the unadjusted and the final adjusted logistic regression models are presented in Table 4. Results from the univariate model suggest a strong association between number of chronic conditions and medical errors with an OR of 2.45 (95% CI: 2.32–2.59) among those with 1 chronic condition and an OR of 8.10 (95% CI: 7.46–8.81) among those with ≥3 chronic conditions. When age, gender, race/ethnicity, hospital location, hospital type, hospital teaching status, disease severity, and LOS were added to the model, the ORs of medical errors for chronic conditions became smaller. Severity of disease had a much stronger confounding effect than LOS on the association between number of chronic conditions and medical errors, and the severity of disease variable had the strongest effect in the multivariable model. Results from multivariable modeling the number of chronic conditions as a continuous variable (data not shown) support our findings that there was a statistically significant association between the number of chronic conditions and medical errors, but the relationship leveled off after the total number of chronic conditions reached ≥3 (similar to the result shown in Fig 1 when LOS is considered).
DISCUSSION

Results in this study show that a total of 44.1% of pediatric inpatients in the 2006 KID had chronic medical conditions. Pediatric patients with chronic conditions had significantly higher rates of iatrogenic medical errors per 100 discharges and per 1000 inpatient days than those without chronic conditions. There was a statistically significant association between the number of chronic conditions and hospital-reported medical errors after controlling for age, gender, race/ethnicity, hospital characteristics, disease severity, and LOS. These results suggest that the presence of chronic conditions and disease severity may be useful warning indicators for clinicians to identify needed strategies to prevent iatrogenic medical errors.

Per our knowledge, this is the first study to report a strong association between chronic medical conditions and higher rates of medical errors in pediatric inpatients. Previous studies established associations of preexisting chronic conditions with longer hospital LOS and higher charges among pediatric patients.7,14 There is also a known relationship between iatrogenic medical errors and increased LOS and charges.2,3,15,16 Our study adds a new finding that chronic medical conditions may put pediatric inpatients at a significantly higher risk for iatrogenic medical errors during their hospitalization. Further research and intervention studies are needed to develop effective interventions to reduce the potential risk of iatrogenic medical errors when pediatric patients with chronic medical conditions are treated at hospitals.

Slonim et al3 reported medical error rates in US pediatric inpatients using HCUP data for the years 1991, 1994, and 1997, and these are statistically no different from the rate seen in our study based on the 2006 KID. The finding that pediatric inpatients with chronic conditions have higher risk of medical errors is consistent with the previous study by Slonim et al. They found that children with special medical needs or technology dependence had significantly higher rates of hospital-reported medical errors than children without special medical needs. They defined children with special care needs based on ICD-9-CM supplementary V codes, which was more limited than our definition of chronic conditions that were developed by the AHRQ by using all ICD-9-CM codes. The 2 definitions partially overlap, but our definition covered a larger population of pediatric inpatients with medical complexity than the definition used in the study by Slonim et al. Previous studies have used similar ICD-9-CM codes in administrative databases to define chronic conditions among US children,7,14,17 and the HCUP Chronic Condition Indicator has also been previously used to study adults.18,19 The Chronic Condition Indicator in the HCUP data may provide a useful tool for pediatric medical care quality research; however, no published study has used this tool in pediatric populations.12 Consistent with an earlier study,3 our results show that drug errors were infrequent (<0.1%) compared with other categories of medical errors in pediatric inpatients. However, other researchers reported much higher rates of medication errors ranging from 1.5% to 6% depending on the methods used to identify drug errors.20 The explanation for our findings of low drug error rates is perhaps because we used a more limited measure for drug errors than the other researchers.

An important strength of our study is that the KID data set contains uniformly
organized data from a large national sample, and it has weighting variables that allow calculation of national estimates of iatrogenic medical errors in pediatric patients with and without chronic medical conditions. The large sample size in KID is also a prerequisite when studying rare events such as medical errors. There are, however, some limitations that need to be considered when interpreting our results. First, underreporting of medical errors might be a limitation of our study. The overall rate of medical errors per 100 hospital discharges in our study was comparable with rates reported in previous studies. However, our study relied on a small group of ICD-9-CM codes in an administrative database to define cases of iatrogenic medical errors. Physicians and hospitals can vary in their reporting of errors in the medical record. Also, the assignment of codes is dependent on the coders’ skill and interpretation of the information in the medical charts. A number of studies have compared the 3 main methods of detecting medical errors: voluntary reporting of sentinel events as mandated by oversight bodies, the commonly used AHRQ’s Patient Safety Indicators or other methods based on administrative discharge ICD-CM codes, and the newer Global Trigger Tool that uses specific methods for reviewing medical charts that lead to further investigation to confirm medical errors. Voluntary reporting and administrative databases were found to underestimate medical errors. Although the Global Trigger Tool seems to capture more medical errors than voluntary reporting and administrative discharge data based on ICD-9-CM codes, the tool’s approach is too resources-intensive to be implemented nationally. A recent study from the United Kingdom reported that the Global Trigger Tool has a limited ability to detect medical errors and may not be an attractive alternative to record review. There is a consensus that no “gold standard” exists for the detection and classification of medical errors. The selected approach is often determined by the users’ constraints and purposes.

The objectives of the current study were to investigate whether there is an association between chronic conditions and iatrogenic medical errors and to evaluate the impact of disease severity and LOS on that association. As such, we have confidence that the results and findings in this study are useful in directing future research efforts and intervention programs. Although these ICD-9-CM codes give information on whether a medical error occurred, they do not offer any information on the severity or significance of the medical error. In addition, our measurement of chronic conditions relied on the Chronic Condition Indicator variable provided in the KID. Although the Chronic Condition Indicator system was based on previous comprehensive research and has been used by others, this tool needs to be further evaluated and validated in pediatric patients.

**CONCLUSIONS**

This study suggests that pediatric inpatients with chronic conditions have a higher risk of iatrogenic medical errors than those without chronic conditions. Further research is needed to confirm these findings and to develop methods for more accurate detection and classification of medical errors.

---

**TABLE 4 Logistic Regression Models of MEs Among Pediatric Inpatients**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate Models</th>
<th>Multivariable Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>No. of chronic conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>1</td>
<td>2.45 (2.32–2.58)</td>
<td>1.40 (1.32–1.48)</td>
</tr>
<tr>
<td>2</td>
<td>4.51 (4.24–4.81)</td>
<td>1.55 (1.45–1.66)</td>
</tr>
<tr>
<td>≥3</td>
<td>8.10 (7.46–8.81)</td>
<td>1.66 (1.53–1.81)</td>
</tr>
<tr>
<td>Age group, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>6–12</td>
<td>2.26 (2.11–2.42)</td>
<td>1.89 (1.76–2.03)</td>
</tr>
<tr>
<td>13–18</td>
<td>1.52 (1.42–1.63)</td>
<td>1.65 (1.55–1.76)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.34 (1.31–1.37)</td>
<td>1.20 (1.16–1.23)</td>
</tr>
<tr>
<td>Female</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1.37 (1.23–1.52)</td>
<td>1.29 (1.22–1.37)</td>
</tr>
<tr>
<td>Other</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Hospital location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>0.38 (0.31–0.46)</td>
<td>1.24 (1.04–1.48)</td>
</tr>
<tr>
<td>Rural</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Hospital type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children’s hospital</td>
<td>5.41 (4.89–6.24)</td>
<td>2.54 (2.21–2.92)</td>
</tr>
<tr>
<td>Children’s unit of a general hospital</td>
<td>4.56 (3.96–5.24)</td>
<td>2.20 (1.93–2.51)</td>
</tr>
<tr>
<td>Nonchildren’s hospital</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Hospital teaching status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>3.74 (3.17–4.41)</td>
<td>1.52 (1.38–1.67)</td>
</tr>
<tr>
<td>Nonteaching</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Disease severity (APR-DRG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.74 (2.62–2.85)</td>
<td>1.67 (1.50–1.74)</td>
</tr>
<tr>
<td>Major</td>
<td>6.93 (6.42–7.48)</td>
<td>3.45 (3.21–3.72)</td>
</tr>
<tr>
<td>Extreme</td>
<td>23.7 (22.0–25.7)</td>
<td>6.17 (5.60–6.81)</td>
</tr>
<tr>
<td>LOS, d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–2</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>3–7</td>
<td>2.11 (2.02–2.19)</td>
<td>1.40 (1.34–1.46)</td>
</tr>
<tr>
<td>8–14</td>
<td>6.68 (6.28–7.12)</td>
<td>2.39 (2.33–2.57)</td>
</tr>
<tr>
<td>≥15</td>
<td>13.2 (12.3–14.2)</td>
<td>3.37 (3.08–3.68)</td>
</tr>
</tbody>
</table>

ME, medical error.
conditions. After consideration of disease severity, LOS, and other patient and hospital characteristics, there was still an association between the presence of chronic medical conditions and iatrogenic medical errors. Clinicians need to be cognizant of these risks when treating pediatric patients with chronic conditions, and future studies need to be conducted to corroborate or refute the findings reported here.

ACKNOWLEDGMENTS

Krista Wheeler is acknowledged for her writing assistance. The authors also thank Dr Kelly Kelleher and Dr Jonathan Groner for their helpful review comments.

REFERENCES

Medical Errors in US Pediatric Inpatients With Chronic Conditions
Namrata Ahuja, Weiyan Zhao and Huiyun Xiang

Pediatrics; originally published online September 10, 2012;
DOI: 10.1542/peds.2011-2555

The online version of this article, along with updated information and services, is located on the World Wide Web at:
/content/early/2012/09/04/peds.2011-2555