

Patient Characteristics Associated With Voluntary Safety Event Reporting in the Acute Care Setting

Danielle P. Thurtle, MD, Sara B. Daffron, MD, Elizabeth E. Halvorson, MD, MS

ABSTRACT

OBJECTIVES: Adverse events are increasingly important to health care delivery and financial reimbursement. Most hospitals use voluntary event reporting (VER) systems to detect safety events, which may be vulnerable to individual and systemic biases. We tested the hypothesis that patient demographic factors such as weight status and race would be associated with safety event reporting in the acute care setting.

METHODS: We reviewed all acute care encounters for patients 2 to 17 years of age and corresponding safety events entered in the VER system of a tertiary-care children's hospital from February 2015 to February 2016. Data collected included patient demographics, clinical characteristics, incident description, and reported harm score. Our primary outcome was any report of a safety event. Using χ^2 and multivariable logistical regression methods, we determined patient characteristics associated with safety event reporting.

RESULTS: A total of 22 056 patient encounters were identified, and 341 (1.5%) of those had a reported safety event. In univariate analysis, age, weight category, and race were found to be significantly associated with event reporting, whereas sex and insurance provider were not. In the multivariable logistic regression model, obesity (odds ratio [OR] 0.69; 95% confidence interval [CI] 0.49–0.97) and African American race (OR 0.65; 95% CI 0.46–0.93) were negatively associated with event reporting, whereas length of stay was positively associated (OR 1.51; 95% CI 1.46–1.55).

CONCLUSIONS: We identified associations between patient demographic factors and voluntary safety event reporting in the acute care setting. In future studies, we will compare VER to event identification by more objective measures, such as a trigger tool.

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Since the publication of *To Err is Human* in 1999,¹ patient safety has risen to the top of the national health care agenda in the United States. In pediatric inpatients, adverse events are a significant burden on health care resources and an important cause of morbidity and mortality.^{2,3} Adverse events are estimated to occur in up to one-third of pediatric admissions, with a large percentage of these events being preventable.^{4–10} The cost of adverse events in pediatric patients alone are estimated to exceed \$1 billion and account for >4400 pediatric deaths per year.^{3,11}

Safety events may occur in certain racial, ethnic, and socioeconomically disadvantaged populations at a higher frequency.¹² Children with obesity may also be at increased risk of some types of events.¹³ Most of the work looking at patient safety and socioeconomic disparities have used broad chart review with administrative cost data or trigger tools. Authors of the largest study in pediatrics looked at racial disparities across the Agency for Healthcare Research and Quality's Pediatric Quality Indicators and found numerous areas with racial, ethnic, and economic disparities.¹⁴

Most hospitals use voluntary event reporting (VER) systems, not universal chart review or trigger tools, to detect safety events.⁵ These systems rely on individuals to initiate a report on the basis of clinical concerns and have no mechanism for automated event detection. One large multicenter study revealed that VER underreported events at a rate of 93% when compared with a pediatric trigger tool.⁵ There are likely many factors that contribute to decreased frequency of reporting using VER, including inconvenience and time required. However, VER may also be subject to bias from providers, which could affect the frequency and types of patients and problems reported. Little research has been done on demographic and patient factors associated with safety event reporting in VER systems, despite its widespread use as the sole mechanism of event detection in most hospitals in the United States. Our objective of this study was to examine patient and

demographic factors associated with voluntary safety event reporting in the acute care setting.

METHODS

Study Setting, Design, and Sample

This study was performed in a 160-bed tertiary-care academic hospital with >4500 pediatric admissions per year. We performed a retrospective cohort study of all pediatric patients 2 to 17 years old seen for an acute care encounter between February 2015 and February 2016. Acute care encounters were defined as any patient admitted to the emergency department, operating room, or inpatient pediatric unit (including ICUs). This study was approved by the local institutional review board.

Patients aged <2 years were excluded because overweight and obesity are not consistently defined in this age group.¹⁵ Patients admitted to outlying hospitals were also excluded because these facilities do not use institutional VER for event reporting. We included the first encounter during the study period for each patient.

Patient Characteristics

For all patient encounters, age, sex, height, weight, race or ethnicity, insurance provider, and length of stay (LOS) were collected. These variables were chosen on the basis of previous literature examining patient characteristics and socioeconomic disparities in safety events and their ability to be reliably extracted from the medical record.^{12,13} We accepted heights and weights within 3 months of the index encounter; patients without height and weight in that time frame were excluded. BMI category was defined as underweight, healthy weight, overweight, and obese according to the Centers for Disease Control and Prevention definitions.^{15,16} Race or ethnicity was patient reported as documented within the electronic medical record and were defined as white, African American, Hispanic, and other. Insurance provider was taken at the time of chart review and categorized as either public or private.

Safety Event Reporting

All reports submitted to the hospital VER system during the same time period were

reviewed. Encounters were matched to reports submitted to the VER system by using medical record number and encounter date. This institution uses the VER system RL Solutions as its primary method of recognizing adverse safety events.

Statistical Analysis

Descriptive statistics were used to define these demographic categories. Our primary outcome was any report of a safety event and was compared between patient characteristics by using Pearson's χ^2 analysis for proportions and univariate logistic regression. All demographic characteristics found to be significant in the univariate analysis were incorporated into multivariable logistic regression models of event reporting. A P value < .1 was considered significant for inclusion in the model; otherwise, P < .05 was used to define statistical significance. All analyses were performed with SAS version 9.4 (SAS Institute, Inc, Cary, NC).

RESULTS

During the study period, 22 062 patients aged 2 to 17 years with an acute care encounter were identified for inclusion (Fig 1). Eight were excluded because of missing BMI data, resulting in a final cohort of 22 056 patients.

Our cohort was 52.4% boys and had a median age of 8 years (interquartile range [IQR] 4–13). Median LOS was 0.09 (IQR 0.05–1.9) days. A total of 5.4% were classified as underweight, 53.6% as normal weight, 15.6% as overweight, and 25.4% as obese. A total of 48.3% of patients reported their race or ethnicity as white non-Hispanic, 28.6% as African American non-Hispanic, 19.9% as Hispanic, and 3.1% reported as other.

Three hundred and forty-one patients (1.5%) had at least 1 safety event reported during the study time period. Demographics of patients with and without reported adverse events are shown in Table 1. Patient characteristics with significant differences between those with and without a reported safety event included BMI classification ($P = .03$), age ($P < .01$), and race or ethnicity ($P < .01$). LOS differed significantly between patients with and without a

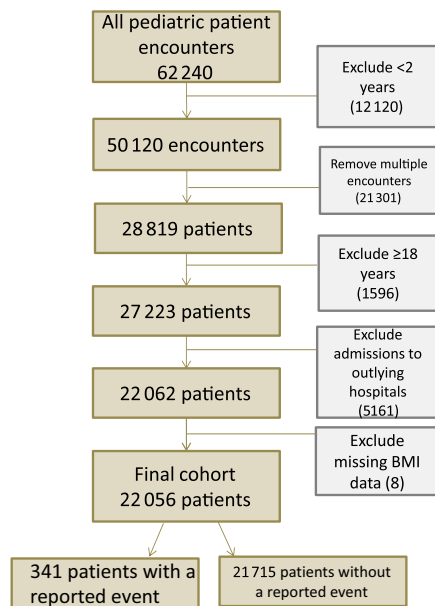


FIGURE 1 Flowchart of cohort identification.

reported safety event ($P < .01$); it is unknown if this was a predictor or consequence of the safety event.

In Fig 2, we show results of multivariable logistical regression model incorporating significant patient characteristics. In this model, patients with obesity (odds ratio [OR] 0.69; 95% confidence interval [CI]

0.49–0.97) and African American race (OR 0.65; 95% CI 0.46–0.93 relative to white race) remained significantly less likely to have a safety event reported. LOS was positively associated (OR 1.51; 95% CI 1.46–1.55) with safety event reporting.

DISCUSSION

In this study, we demonstrated decreased reporting of safety events in patients with obesity and those of African American race using a VER system. To our knowledge, this is the first study used to identify associations between demographic characteristics of pediatric patients and voluntary safety event reporting. This result is not consistent with research on actual frequency of adverse events and quality indicators in the literature, which suggests patients with obesity and those of African American and Hispanic race are more likely to experience a safety event during their hospital encounter.^{12,13} By using the VER system, we only detected events reported by providers, which could be influenced by many factors, including the perceived severity of the event, the awareness of different medical team members of the event, and conscious or unconscious bias of the provider toward different patient populations. Provider bias has been

demonstrated toward patients with obesity and minority race, although there is mixed evidence on bias influencing patient care.^{17–22}

We did not detect a statistically significant difference in event reporting for patients with public versus private insurance. In looking at the frequency of safety events in the literature, results are mixed. Authors of some large studies using hospital administrative data did find significantly higher rates of safety events in patients with public insurance, but authors of studies using more thorough chart review suggest this may be attributable to patient health characteristics.^{23,24}

We recognize limitations to this study. The results from this single-center study may have limited generalizability. It should be noted that the baseline event reporting rate of 1.5% is similar to studies used to examine VER previously.^{5,25,26} Because our study did not include chart review of all encounters for the actual frequency of safety events, we cannot say if this difference in frequency of reported events is equal to a difference in frequency of actual safety events. We also recognize that excluding patients <2 years of age likely skews the age data and excludes a significant patient population in pediatrics. We did not include medical complexity or primary language in this study, although these have been associated with adverse events. Further studies should be conducted in which authors use trigger tools or other less subjective forms of event detection to compare provider reporting with the true frequency of safety events in different patient populations.

CONCLUSIONS

Given that VER is currently the industry standard in safety event detection for most children's hospitals, it is important to examine the validity and weaknesses of this system. It is suggested in this study that VER may underreport safety events in socioeconomically vulnerable populations. More research is needed to determine if discrepancies in event reporting between different demographic groups correlate with the true frequency of patient safety events.

TABLE 1 Demographics and Characteristics of Patients With and Without Safety Events Reported

	Patients With Event Reported (N = 341)	Patients Without Event Reported (N = 21 715)	P ^a
Age, median (IQR)	11 (7–15)	8 (4–13)	<.01
Boys, n (%)	167 (49.0)	11 400 (52.5)	.20
BMI category, n (%)			.03
Underweight	18 (5.3)	1163 (5.4)	
Normal wt	205 (60.1)	11 619 (53.5)	
Overweight	55 (16.1)	3394 (15.6)	
Obese	63 (18.5)	5539 (25.5)	
Race, n (%) ^b			<.01
White	209 (61.7)	10 449 (48.1)	
African American	58 (17.1)	6245 (28.8)	
Hispanic	59 (17.4)	4330 (20.0)	
Other	13 (3.8)	684 (3.2)	
Private insurance, n (%) ^b	98 (30.3)	6880 (33.2)	.28
LOS, median (IQR), d ^b	6 (3–12)	0.09 (0.05–0.18)	<.01

^a In comparisons, Pearson's χ^2 test was used for categorical variables and analysis of variance for continuous variables.

^b Nine subjects were missing race data, 996 were missing insurance data, and 618 were missing LOS data.

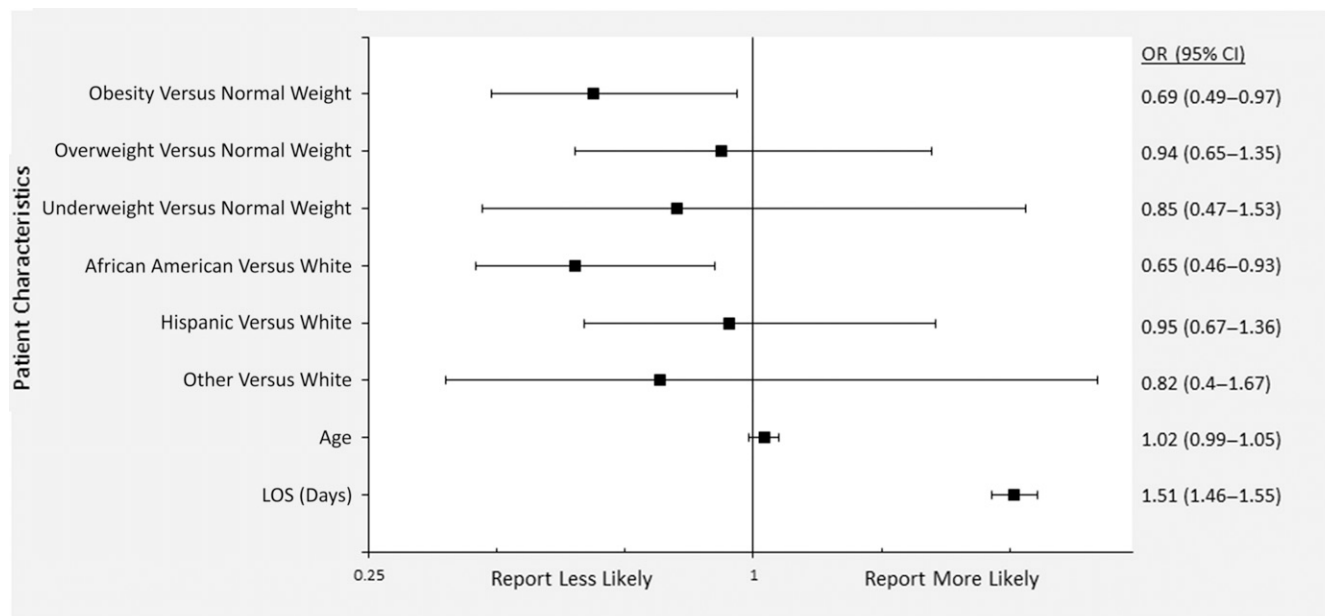


FIGURE 2 Associations of demographic characteristics with adverse event reporting after multivariable logistic regression.

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