Medication-Related Emergency Department Visits in Pediatrics: a Prospective Observational Study

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abstract

BACKGROUND AND OBJECTIVE: There are few data on the rate and characterization of medication-related visits (MRVs) to the emergency department (ED) in pediatric patients. We sought to evaluate the frequency, severity, preventability, and classification of MRVs to the ED in pediatric patients.

METHODS: We performed a prospective observational study of pediatric patients presenting to the ED over a 12-month period. A medication-related ED visit was identified by using pharmacist assessment, emergency physician assessment, and an independent adjudication committee.

RESULTS: In this study, 2028 patients were enrolled (mean age, 6.1 ± 5.0 years; girls, 47.4%). An MRV was found in 163 patients (8.0%; 95% confidence interval [CI]: 7.0%–9.3%) of which 106 (65.0%; 95% CI: 57.2%–72.3%) were deemed preventable. Severity was classified as mild in 14 cases (8.6%; 95% CI: 4.8%–14.0%), moderate in 140 cases (85.9%; 95% CI: 79.6%–90.8%), and severe in 9 cases (5.5%; 95% CI: 2.6%–10.2%). The most common events were related to adverse drug reactions 26.4% (95% CI: 19.8%–33.8%), subtherapeutic dosage 19.0% (95% CI: 13.3%–25.9%), and nonadherence 17.2% (95% CI: 11.7%–23.9%). The probability of hospital admission was significantly higher among patients with an MRV compared with those without an MRV (odds ratio, 6.5; 95% CI: 4.3–9.6) and, if admitted, the median (interquartile range) length of stay was longer (3.0 [5.0] days vs 1.5 [2.5] days, $P = .02$).

CONCLUSIONS: A medication-related cause was found in ∼1 of every 12 ED visits by pediatric patients, of which two-thirds were deemed preventable. Pediatric patients who present to the ED with an MRV are more likely to be admitted to hospital and when admitted have a longer length of stay.

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Dr Zed conceptualized and designed the study, analysis, and interpretation of data, and drafted the initial manuscript; Dr Black contributed to the design of the study, acquisition of data, interpretation of data, and commented on the initial draft of the manuscript; Ms Fitzpatrick and Drs Ackroyd-Stolarz, Murphy, Curran, and Mackinnon contributed to the design of the study, interpretation of data, and commented on the initial draft of the manuscript; Dr Sinclair contributed to the design of the study and commented on the initial draft of the manuscript; and all authors approved the final manuscript as submitted.

WHAT'S KNOWN ON THIS SUBJECT: In adults, adverse drug events account for 5% to 25% of all hospital admissions and 12% of emergency department (ED) visits of which 50% to 70% are preventable. There remains a significant gap in our understanding of the magnitude and impact of medication-related ED visits in pediatrics.

WHAT THIS STUDY ADDS: This study is the largest and most rigorous study performed evaluating the impact of medication-related visits to the ED in pediatrics and provides important information regarding the magnitude of this problem in our health care system.

Adverse drug events (ADEs) are unfavorable occurrences related to the use and misuse of medications.[1] It has been estimated that ADEs account for over 17 million emergency department (ED) visits and 8.7 million hospital admissions annually in the United States.[2,3] A cost-of-illness model estimated that between 1995 and 2000 costs associated with morbidity and mortality secondary to ADEs more than doubled from US$76.6 billion to more than US$177.4 billion and is likely even higher today.[3,4] In recent years, ADEs have been extensively evaluated in ambulatory care,[5–9] ED care,[10–31] and in hospitalized patients.[32–43] Studies have estimated that 5% to 25% of all hospital admissions and up to 12% of ED visits are medication-related, of which 50% to 70% are deemed preventable.[34–44] Studies have involved different methodologies and a spectrum of different inclusion criteria, ranging from studies of narrowly defined adverse drug reactions (ADRs) to more broadly defined medication-related events.

The majority of research performed has provided data for medication-related hospital visits in adults, but this issue has been poorly studied in pediatric patients. In the majority of studies published to-date, pediatric patients were either excluded or significantly underrepresented among the study population. Those studies that have been performed in pediatric patients have used retrospective design or significantly limited prospective methodologies, which preclude accurate determination of the magnitude of this issue.[16,45–55] Retrospective evaluation, often conducted by using medical record review or use of administrative databases, has inherent limitation for reporting bias, challenges with event ascertainment, as well as causality and preventability assessment, and has reported much lower event rates compared with prospective studies.[11,56] Finally, no study has prospectively explored this issue in Canada, so the impact in our own country remains uncertain. The incidence and classifications of medication-related ADEs in pediatrics cannot be expected to be the same as adults due in large part to the age-related prevalence of disease, as well as the spectrum and scope of medication use. As a result, approaches to identify and prevent ADEs in pediatric patients will also be unique. Thus, there remains a significant knowledge gap in our understanding of the magnitude and impact of medication-related ED visits in pediatric patients.

We sought to evaluate the frequency, severity, preventability, and classification of medication-related visits (MRVs) to the ED of a large tertiary-care hospital and to identify patient, prescriber, drug, or system factors associated with these visits.

METHODS

Setting and Population

This prospective observational study was conducted at IWK Health Centre, a 120-bed pediatric tertiary-care, referral, and trauma center and Dalhousie University-affiliated Canadian teaching hospital in Halifax, Nova Scotia. The ED treats ~28 000 patients annually and is staffed by physicians board-certified in emergency medicine or pediatrics. The study was coordinated by the Department of Emergency Medicine, IWK Health Centre. Ethics approval was obtained from the IWK Health Centre Research Ethics Board, and all participating patients provided signed informed consent.

All patients presenting to the ED during a 1-year period from November 1, 2011, to October 31, 2012, were eligible for enrollment. The decision to enroll patients over a 1-year period was made a priori based on a sample size projection to achieve a sufficiently narrow 95% confidence interval (CI; +/−4%) around the primary outcome estimate to permit robust conclusions. To ensure a representative sample of patients were enrolled, data collection shifts were stratified a priori by day of week and time of day (0100–0859 h, 0900–1659 h, 1700–0059 h). Patients presenting during data collection shifts over the study period were systematically sampled by using time to presentation to ED triage. Using a computerized randomization program, 1 patient was selected from all patients who presented in the 1-hour period before the start of each data collection shift. Once the first patient was randomly selected at time $t_{=0}$, subsequent patients were enrolled at a fixed time interval of 20 minutes from the time of presentation of the first patient. In situations where a patient was selected, but deemed ineligible based on exclusion criteria, the next patient presenting after the ineligible patient was selected. Patients selected for enrollment more than once during the study period were entered as discrete visits. Patients were excluded if they were returning to the ED for a scheduled visit (eg, outpatient antibiotics).

Data Collection and Case Definitions

Data were collected by using a personal digital assistant-based electronic data collection form (Pendragon Software Corporation, Libertyville, IL) by 1 residency-trained pharmacist research assistant experienced in the pharmacotherapeutic aspects of pediatric acute care medicine.

Each patient and their family were interviewed to determine chief complaint, history of present illness, past medical history, medication history, and allergy status. Medication history included prescription, over-the-counter, and complementary and alternative medications. Additional information was obtained when necessary from family physicians, specialists, and their community

pharmacy. Information from the physical examination conducted by the attending emergency physician or medical trainee, laboratory results, and diagnostic tests were used when necessary. All such assessments and evaluations were at the discretion of the attending emergency physician, and clinical care and laboratory testing was unaltered as a result of this study. Patients were followed until discharge from the ED or, if admitted, until hospital discharge. Patients were contacted by telephone up to 30 days after hospital discharge for the evaluation of progress and outcomes.

Outcome Measures

An ED visit was deemed medication-related if the presentation was directly related to the presenting chief complaint and classified into 1 of 8 predefined categories: ADR, drug interaction, improper drug selection, untreated indication, subtherapeutic dosage, supratherapeutic dosage, nonadherence, and drug use without indication (Supplemental Table 5).[57] If a medication-related problem was found incidentally but was unrelated to the presenting chief complaint, the visit was not considered medication-related.

The Lexi-Pediatric Suite (Lexi-Comp, Inc, Hudson, OH) was used to obtain drug information and perform drug interaction analysis at the point of care. In addition, the attending emergency physician responsible for the care of each patient was asked if they felt that the visit was medication-related, and if so the nature of the medication-related cause. To allow determination of physician/pharmacist agreement, the emergency physician's assessment was made without knowledge of the pharmacist's assessment.

Causality was determined by using both the modified World Health Organization algorithm and the modified Naranjo algorithm.[58,59] An adverse drug-related event was considered to be present if the World Health Organization algorithm was deemed "certain" or "probable" or the Naranjo algorithm was deemed "definite" or "probable".

Severity was defined as mild (laboratory abnormality or symptom not requiring treatment), moderate (laboratory abnormality or symptom requiring treatment/hospitalization or resulting in nonpermanent disability), severe (life threatening or resulting in permanent disability), or fatal.[30,35]

Medication-related ED visits were defined as preventable if drug treatment, or lack thereof, was inconsistent with current best practice. This included the following: inappropriate drug, dosage, route, or frequency for patient's clinical condition, age, weight, renal function; known drug allergy or previous reaction to drug; known drug interaction; nonadherence; laboratory monitoring not performed; and prescribing, dispensing, or administration errors.[30,35,58–61]

Cases in which there was discordance between the pharmacist and emergency physician categorizations were independently adjudicated by 2 external reviewers (1 physician pediatrician and 1 pharmacist) by using explicit criteria and a predefined approach.[9,30,43] Standardized case summaries were prepared by the research pharmacist for review by the external reviewers. These case summaries included all relevant history obtained during the index visit and, where applicable, information obtained from 1-month follow-up. Each adjudicator determined the likelihood of the visit being drug-related by using a 6-point Likert scale. If both reviewers rated the visit as 4 (possibly drug-related but more likely due to drug[s]) or higher, it was deemed to be drug-related. If both reviewers rated the visit as 3 (possibly drug-related but more likely not due to drug[s]) or less, it was not deemed to be drug-related. If there was disagreement in the ratings, the reviewers discussed the case to achieve consensus.

Statistical Analysis

Patient demographics were summarized by using means and SDs or medians and interquartile ranges for continuous data, and frequencies and percentages for categorical data. The primary outcome was reported as a percentage with 95% CI, calculated by using the Clopper-Pearson (Exact) method. The 95% CIs were calculated similarly for the percentages of patients admitted to hospital with medication-related and non-MRVs. Univariate association between hospital admission and MRVs was calculated by using odds ratios (ORs). The length of hospital stay for medication-related and nonmedication-related hospital admissions was compared by using the Mann-Whitney nonparametric test. The frequency of MRVs in relation to time of day was compared by using the χ^2 test.

Multivariate logistic regression was used to identify predictors to evaluate associations between MRVs and patient, prescriber, drug, and system factors. Covariates, determined a priori were as follows: age, gender, education level of parent/guardian, household income, ED arrival time period, use of complementary and alternative medications, drug plan, use of adherence aid (alarm, blister pack, calendar, dosette, or home care/registered nurse/caregiver assistance), use of multiple pharmacies, multiple prescribers, regular family physician, primary medication administration, Canadian Triage Acuity Scale (CTAS),[62] number of comorbidities, and number of medications. The multivariate logistic model was built to include all potential predictors, while checking for multicollinearity. If multicollinearity was present, the least relevant variable was taken out of the multivariate analysis. All categorical variables were

dummy-coded for inclusion in a regression analysis. Univariate analyses were conducted for each potential predictor. From the univariate analyses, predictors with associations of a P value level $<.05$ were selected for inclusion in the multivariate model. A backward stepwise approach was used to develop the final model, retaining only the variables with P value $<.05$. The Hosmer-Lemeshow statistic was used to assess the model fit. Analyses were performed by using SAS, version 9.2 (SAS Institute, Inc, Cary, NC).

RESULTS

Overall, 2199 were selected for enrollment of whom 139 (6.3%) refused participation, and 32 (1.5%) were excluded due to having a scheduled ED visit. Thus, 2028 patients were included in the final analysis. Patient demographics are outlined in Table 1. The mean age of included patients was 6.1 years (±5.0), 47.4% were girls, 96.8% had a regular family physician, and 97.2% were brought to the ED from home by a family member.

An MRV was found in 163 patients (8.0%; 95% CI: 7.0%–9.3%) of which 106 (65.0%; 95% CI: 57.2%–72.3%) were deemed preventable. Severity was classified as mild in 14 cases (8.6%; 95% CI: 4.8%–14.0%), moderate in 140 cases (85.9%; 95% CI: 79.6%–90.8%), and severe in 9 cases (5.5%; 95% CI: 2.6%–10.2%). Among the 2028 enrolled patients, there was concordance between the pharmacist and emergency physician in 1976 patients (97.2%; MRV [n = 140] and non-MRV [n = 1836]). The adjudication committee reviewed the 52 discordant cases and deemed 23 of 52 (44.2%) to be an MRV. Overall, there was concordance between the pharmacist and the emergency physician in 140 of 163 patients (85.9%) determined to be an MRV.

The most common events were related to ADRs 26.4% (95% CI: 19.8%–33.8%), subtherapeutic dosage 19.0% (95% CI: 13.3%–25.9%), and nonadherence 17.2% (95% CI: 11.7%–23.9%; Table 2). The frequency of MRV was unrelated to time of day; such visits occurred in 8.4% of day visits (78 of 931, 95% CI: 6.7%–10.4%), 8.1% of evening visits (79 of 976, 95% CI: 6.5%–10.0%), and 5.0% of night visits (6 of 121, 95% CI: 1.8%–10.5%), P = .43.

A total of 201 drugs (78 different agents), were implicated in the 163 MRVs (Table 3); 136 patients (83.4%) had 1 drug implicated, 16 patients (9.8%) had 2 drugs implicated, and 11 patients (6.8%) had 3 drugs implicated. The most common drug classes were antiinfectives (27.4%), respiratory agents (22.4%), central nervous system agents (20.4%), immunosuppressants (7.5%), and gastrointestinal agents (6.0%).

Overall, 145 patients (7.2%) were admitted to hospital during the study period. This included 44 of 163 patients (27.0%; 95% CI: 20.4%–34.5%) with an MRV and 101 of 1865 patients (5.4%; 95% CI: 4.4%–6.5%) whose visit was not medication-related. The probability of admission for patients who presented with an MRV was significantly higher than those who presented without (OR, 6.5; 95% CI: 4.3–9.6, $P < .0001$). The median (interquartile range) length of stay for all admitted patients was 2.0 (4.0) days. Length of stay was longer for those with a drug-related visit (3.0 [5.0] days) than those without (1.5 [2.5] days), P = .02. There were no deaths in patients admitted after an MRV.

On univariate analysis, age, the number of comorbidities, number of medications, the use of multiple pharmacies, and the use of multiple prescribers were found to be significantly associated with MRVs. Multicollinearity was present between the use of multiple pharmacies and the use of multiple prescribers and the number of

TABLE 1 Patient Demographics (N = 2028)

Characteristics	n (%)
Age, mean (SD)	6.1 (5.0)
Age category	
≤3 mo	106 (5.2)
>3 mo–1 y	182 (9.0)
>1–5 y	729 (36.0)
>5–12 y	619 (30.5)
>12–19 y	392 (19.3)
Gender	
Girl	962 (47.4)
Boy	1066 (52.6)
No. of comorbidities, mean (SD)	1.7 (1.8)
No. of comorbidities	
0	1377 (67.9)
1	474 (23.4)
2	134 (6.6)
3	31 (1.5)
>3	12 (0.6)
Total no. of medications, mean (SD)	1.1 (1.3)
Total no. of medications	
0	870 (42.9)
1	587 (28.9)
2	341 (16.8)
3	133 (6.6)
>3	97 (4.8)
Complementary and alternative medication use	55 (2.7)
Drug plan (public/private)	
Yes	1686 (83.2)
No	237 (11.7)
Not obtained	105 (5.2)
Household income	
<$50 000	562 (27.7)
$50 000–$100 000	690 (34.0)
>$100 000	536 (26.4)
Not obtained	240 (11.8)
Level of education (parents/guardian)	
Less than high school	144 (7.1)
High school and some postsecondary	451 (22.2)
Postsecondary completed	1307 (64.5)
Not obtained	126 (6.2)
No. of pharmacies	
1	632 (31.2)
>1	63 (3.1)
None	1333 (65.7)
Regular family physician	1963 (96.8)
No. of physician prescribers	
1	1454 (71.7)
>1	84 (4.1)
None	488 (24.1)
Not obtained	2 (0.1)
Residence before presentation	
Home	1982 (97.7)
Other hospital	46 (2.3)
ED arrival mode	
Family	1972 (97.2)
Emergency health service	34 (1.7)
Self	18 (0.9)

TABLE 1 Continued

Characteristics	*n* (%)
Police	4 (0.2)
CTAS[61] score	
1 (time to physician guideline: immediate)	14 (0.7)
2 (time to physician guideline: <15 min)	227 (11.2)
3 (time to physician guideline: <30 min)	596 (29.4)
4 (time to physician guideline: <60 min)	1180 (58.2)
5 (time to physician guideline: <120 min)	11 (0.5)

Data are presented as *n* (%) unless noted otherwise.

comorbidities. Hence, the use of multiple pharmacies variable was not evaluated in the final model. After multivariable adjusted analysis modeling, the following were found to be independently associated with MRVs: age, CTAS, and number of comorbidities (Table 4).

DISCUSSION

Our findings indicate that adverse medication-related events comprise 8% of pediatric ED visits and 65% are potentially preventable. Hospitalization rates are higher and length of stay is longer for patients presenting with an MRV compared with patients admitted for other reasons. Our prospective design, large sample size, use of causality assessment tools, and independent adjudication committee increase the likelihood that our estimates are precise. In addition, our use of a careful systematic sampling strategy and a priori enrollment stratification increases the generalizability of our findings.

This is the first prospective study performed in Canada, which has explored the impact of ADEs in pediatric patients who result in ED visits. Surprisingly, our results are similar to the rate of medication-related ED visits in adults in Canada, recently reported at 12%.[30] Our prospective design and follow-up at 1-month after the index visit allowed for complete medical and medication histories and ensured all information required to accurately classify cases was obtained. Second, we used an experienced clinical pharmacist trained in the recognition and resolution of ADEs in pediatric patients and considered their assessment in combination with an independent emergency physician assessment. Previous work has revealed that the rate of emergency physicians' recognition of adverse drug-related events is ~50%, thus studies that rely solely on this assessment will underestimate the incidence of drug-related visits.[29] Finally, our use of a comprehensive classification system increases the likelihood that all medication-related causes of ED visits were identified. Our inclusion of medication nonadherence as a medication-related reason for an ED visit is unique, and reflects our belief that this should be included in estimates of the burden of MRVs. McGrady and Hommel[63] recently reported the significant impact of medication nonadherence and the related increased health care use in children and adolescents who have a chronic medical condition.

The classifications, specific drug therapies, and high rate of preventability identified in our study are consistent with previous reports.[30,44] Although the overall hospitalization rate we found was also consistent with previous reports, the increased admission rate in patients with an MRV was striking. It remains unclear whether this represents association, causation, or a combination of both, but this increased rate of admission and longer length of stay when admitted is also consistent with adult patients.[30] It is possible that because adverse drug-related events often require time and monitored observation for treatment or resolution, hospital admission is more frequently indicated. Specific risk factors for MRVs are inconsistently identified in the literature[56]; however, we were able to identify age, CTAS, and the number of comorbidities as predictors of MRVs. These 3 factors would suggest that as patients get older and experience more comorbidities, it would result in a greater likelihood of medication exposure and as a result would predict a greater chance of experiencing an ADE, which would result in an ED visit.

TABLE 2 Classification, Preventability, and Severity of Medication-Related ED Visits

Category	All (Drug-Related) Visits, *n* = 163		Preventable Visits, *n* = 106		Severity No. (%)[a]		
	No. (%)	95% CI	No. (%)[a]	95% CI[b]	Mild, *n* = 14	Moderate, *n* = 140	Severe, *n* = 9
ADR	43 (26.4)	(19.8–33.8)	7 (16.3)	(6.8–30.7)	5 (11.6)	35 (81.4)	3 (7.0)
Drug interaction	2 (1.2)	(0.2–4.4)	1 (50.0)	(1.3–98.7)	0 (0.0)	2 (100.0)	0 (0.0)
Drug without indication	10 (6.1)	(3.0–11.0)	10 (100.0)	(69.2–100.0)	4 (40.0)	6 (60.0)	0 (0.0)
Improper drug selection	20 (12.3)	(7.7–18.3)	5 (25.0)	(8.7–49.1)	0 (0.0)	20 (100.0)	0 (0.0)
Nonadherence	28 (17.2)	(11.7–23.9)	28 (100.0)	(87.7–100.0)	0 (0.0)	26 (92.9)	2 (7.1)
Subtherapeutic dosage	31 (19.0)	(13.3–25.9)	27 (87.1)	(70.2–96.4)	2 (6.5)	26 (83.9)	3 (9.7)
Supratherapeutic dosage	16 (9.8)	(5.7–15.4)	15 (93.8)	(69.8–99.8)	3 (18.8)	12 (75.0)	1 (6.3)
Untreated indication	13 (8.0)	(4.3–13.3)	13 (100.0)	(75.3–100.0)	0 (0.0)	13 (100.0)	0 (0.0)

[a] Percentages for preventability and severity were calculated on the basis of the number of visits in each category.
[b] 95% CIs were calculated by using the Clopper-Pearson (Exact) method.

TABLE 3 Medications Associated With Medication-Related ED Visits (n = 201)

Drug Class[a]	n (%)
Antimicrobial agents	55 (27.4)
β-lactam agents	31 (15.4)
Macrolides	7 (3.5)
Vaccines	7 (3.5)
Sulfonamide-containing agents	3 (1.5)
Other antimicrobial agents	7 (3.5)
Respiratory tract agents	45 (22.4)
Inhaled corticosteroids	30 (14.9)
β-2-agonists	15 (7.5)
Central nervous system agents	41 (20.4)
Antidepressants	9 (4.5)
Anticonvulsants	9 (4.5)
Benzodiazepines	8 (4.0)
Antipsychotics	4 (2.0)
Amphetamines/stimulants	4 (2.0)
Other central nervous system agents	7 (3.5)
Immune modifying agents	15 (7.5)
Antineoplastic agents/ chemotherapy	10 (5.0)
Other immune modifying agents	5 (2.5)
Gastrointestinal agents	12 (6.0)
Antisecretory (H2RA/PPI)	8 (4.0)
Other gastrointestinal agents	4 (2.0)
Antidiabetics agents	11 (5.5)
Insulin	10 (5.0)
Oral hypoglycemics	1 (0.5)
Analgesic/antiinflammatory/ antipyretic agents	11 (5.5)
NSAIDs	5 (2.5)
Acetaminophen	4 (2.0)
Other agents	2 (1.0)
Cardiovascular agents	4 (2.0)
Hormones	3 (1.5)
Cough and cold agents	2 (1.0)
Topical acne agent (isotretinoin)	1 (0.5)
Vitamin/supplement (iron)	1 (0.5)

H2RA, histamine-2-receptor antagonist; NSAIDs, non-steroidal antiinflammatory drugs; PPI, proton pump inhibitor.

[a] Two hundred one total drugs were involved in the 163 medication-related ED visits, which included 78 different drugs.

Our study has limitations. First, although our trained research pharmacist used a standardized approach, bias may have occurred in the determination of an MRV. We attempted to minimize this through the use of an independent adjudication process. Second, although a standardized approach was used in the formulation of adjudication case summaries, it is conceivable bias may also have been introduced at this stage. In addition to the case summaries, adjudicators were provided with all relevant medical records and made their assessments without the knowledge of the pharmacist or emergency physician determinations. Third, the increased attention to the subject of MRVs resulting from this study may have heightened emergency physicians' awareness of medication-related issues and introduced a Hawthorne effect. Fourth, inherent in working with a pediatric patient population, we had to rely on family and other sources to ascertain much of the history. Natural questions better answered by the patient could simply not be obtained for this patient group. Finally, given the study location, our results are not necessarily generalizable to community or rural hospitals or hospitals that care for a mix of both adult and pediatric patients.

CONCLUSIONS

Our work reveals the significant impact ADEs have on patients and result in an ED visit. Future research should focus on a number of areas to further our understanding of the burden of medication-related ED visits and improve patient safety. Due to the heterogeneous nature of adverse medication-related events we identified, interventions should focus on those that are most prevalent and where evidence exists to support a preventive strategy. The optimal strategy may involve interventions outside the hospital to improve prescribing practices and monitoring, particularly in high-risk patients or high-risk medications. Interventions that target multiple levels (patients, health care providers, and health care system) to optimize communication between acute and ambulatory settings and improve adherence should also be evaluated. Finally, further research is required to explore the higher admission rate and determine if MRVs to the ED are a marker of sicker patients or an independent factor leading to an increased likelihood of hospital admission.

TABLE 4 Multivariate Logistic Regression Analysis of Factors Associated With Medication-Related ED Visits (N = 2028)

	MRV, n = 163[a]	Non-MRV, n = 1865[a]	OR (95% CI)	P
Age, mean (SD), y	7.84 (5.69)	5.97 (4.85)	1.07 (1.04–1.11)	<.0001
Number of prescribers, n/N (%)				
1	118/162 (72)	1336/1864 (72)	1.09 (0.69–1.73)	.7000
>1	17/162 (10)	67/1864 (4)	1.52 (0.71–3.23)	.2794
None	27/162 (17)	461/1864 (25)	Reference	—
CTAS, n (%)				
Score 1	4 (2)	10 (0.5)	9.26 (2.68–31.97)	.0004
Score 2	43 (26)	184 (10)	5.37 (3.39–8.52)	<.0001
Score 3	67 (41)	529 (28)	2.67 (1.79–3.98)	<.0001
Scores 4 and 5	49 (30)	1142 (61)	Reference	—
Comorbidities, mean (SD)	1.05 (0.95)	0.39 (0.71)	1.85 (1.54–2.22)	<.0001

[a] N for OR calculations differs for some variables due to missing data.

ACKNOWLEDGMENTS

We thank Maja Grubisic, BC Centre for Improved Cardiovascular Health, Vancouver, BC, for providing statistical analysis support; David Urquhart, Department of Emergency Medicine, Dalhousie University, Halifax, NS, for technology and database support; Dr Andrea Murphy, College of Pharmacy, Dalhousie University, Halifax, NS, and Dr Sarah Manos, Department of Pediatrics, IWK Health Centre, Halifax, NS, for serving as members of the adjudication committee; Jennifer Turple, Institute for Safe Medication Practices Canada, for serving as research pharmacist; Christopher Haughn, College of Pharmacy, Dalhousie University, and Dr Anita Kapanen, Faculty of Pharmaceutical Sciences, University of British Columbia, for administrative support; and the emergency physicians and nurses at IWK Health Centre for their support throughout the study.

This work was presented at the annual scientific meeting of the Canadian Association of Emergency Physicians; June 1–5, 2013; Vancouver, BC, Canada.

www.pediatrics.org/cgi/doi/10.1542/peds.2014-1827

DOI: 10.1542/peds.2014-1827

Accepted for publication Dec 9, 2014

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: During the study period, Dr Ackroyd-Stolarz was supported by the Canadian Patient Safety Institute/Canadian Institute for Health Research as the Dr David Rippey Patient Safety Post-Doctoral Fellow; the other authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported by a Health Project grant from the Nova Scotia Health Research Foundation. The funding organization was not involved in the design or conduct of the study; collection, management, analysis, and interpretation of the data; nor preparation, review, or approval of the manuscript.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

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GAMING FOR SCHOLARSHIPS: *One of my sons used to play a lot of video games. One day he happened to mention that his ranking in an online video game played by millions was in the three digits. I did not think too much of his ranking at the time – other than that he was probably playing too much. Perhaps, however, I should have encouraged him to play even more.*

As reported in The New York Times *(Technology: December 8, 2014), video game competitions (also known as e-sports) have soared in popularity on college campuses. Almost twice as many collegians now play in the largest e-sports league, Collegiate StarLeague, than Division I men's basketball. Collegiate teams compete in national competitions similar to those hosted by other sports such as basketball and baseball. The difference is that teams can win monetary prizes –often scholarships for each team member. The tournaments are sponsored by game manufacturers. Last year one manufacturer hosted the first North American Collegiate Championship for its flagship online battle game. The competition was watched by thousands in person and, at one point, 169,000 were watching online. The winning team members each received $7,500 in scholarship money. Next year the winners will take home $30,000.*

Successful gamers are now recognized on campus similar to the way other highly successful athletes are. The goal is create a tight bond between college age participants and the game, and to increase the support and popularity of emerging professional e-sports. The popularity of e-sports is so recent that most schools do not have an official policy regarding participation. Most competitors are on club teams. However, a few schools have recognized video gamers as athletes that bring as much to a school as a football player. This past year, a school in Illinois gave 35 athletic scholarships for students in the new e-sports program. Many will be watching to see how the students and school fare.

As for my son, he still plays online a bit, but I do not think he could make a college e-sports team these days.

Noted by WVR, MD

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