Impact of Physicians' Characteristics on the Admission Risk Among Children Visiting a Pediatric Emergency Department

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Objective: This study aimed to assess the impact of physicians' gender, work experience, and training on hospitalization among children visiting a pediatric emergency department (ED).

Methods: This retrospective cohort study used the computerized database of a tertiary care pediatric ED staffed by pediatric emergency physicians, general pediatricians, and general emergency physicians. Participants were all children evaluated in the ED between April 1, 2008, and March 31, 2009. The primary outcome was hospitalization, and secondary outcome was unscheduled return in the 48 hours after discharge from the ED. Determinants of outcomes were physician's gender, experience, and specialty training. Multivariate logistic regression was used to evaluate associations between physicians' characteristics and the risk of admission, adjusting for referral status, triage level, chief complaints, and other potential risk factors.

Results: Forty-five physicians evaluated 49,146 patients during the study period. Physicians' individual admission and return rates varied from 1% to 24% and 0% to 11%, respectively. On multiple logistic regression, physician's gender was not a predictor of admission but the physician's years of experience was slightly associated with both admission rates and unscheduled return visits. As a group, pediatric emergency physicians demonstrated a lower admission rate than physicians trained in general pediatric or general emergency medicine.

Conclusions: Individual physician's admissions proportions vary widely. Providers' experience and specialization in pediatric emergency medicine are weak predictors of admission, whereas gender was not associated.

Key Words: gender, medical training, hospitalization

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Patients younger than 18 years account for almost 25% of all visits to emergency departments (EDs) in the United States, or more than 20 million annual visits.[1,2] The profile of physicians providing urgent medical care for children is changing. During the past years, pediatric emergency medicine (PEM) has grown as a subspecialty.[3] However, almost 75% of children still seek urgent care in general hospitals and are treated by general emergency medicine (GEM) physicians.[4,5] In the United States, only 7% of hospitals have a separate pediatric ED.[5] Furthermore, studies report an increase of more than 60% in the proportion of women graduating from medical schools in Western countries.[6]

To further explore the potential impact of physicians' training, studies have compared GEM physicians' and PEM physicians' managements of common pediatric problems. Results showed significant variability between GEM physicians and PEM physicians, as well as among PEM physicians themselves.[7–10] Similar studies were conducted comparing outcomes for children treated in pediatric or adult trauma centers with conflicting results.[11–16] Some authors have suggested that competence, expertise, and experience, rather than type of training, may be better predictors of patient outcome than medical training.[17,18] Also, one study found that provider gender influenced pain medication administration in a general ED.[19]

With the feminization of the profession and the development of the specialty of PEM, care of children in the ED may change. To better understand the impact of such factors, we sought to assess the effects of physicians' gender, years of experience, and specialty training on hospitalization rates among children visiting a pediatric ED.

METHODS

Study Design

A retrospective cohort study using the computerized database of a tertiary care pediatric ED was conducted. This study was approved by the institution's review board but because of the use of a de-identified database, informed consent was waived.

Setting

The study was performed in a single pediatric ED within a teaching hospital, located in a large city in Canada. The hospital is a tertiary care, university-affiliated, level 1 pediatric trauma center with approximately 60,000 annual visits. The ED is staffed with full-time accredited PEM physicians, general pediatricians, and GEM physicians. All patients were evaluated by a physician with or without preliminary evaluation by a medical student or a resident. All data, gathered from April 1, 2008, to March 31, 2009, were included in the study.

Participants

Patients eligible for inclusion were all children younger than 19 years who were evaluated by a physician in the ED, during the study period. Children who were registered in the ED but left before being seen by a physician were excluded. Also, patients who were transferred to another facility were excluded. All physicians who evaluated more than 20 patients during the study period were included in the analysis. Physicians working in the study's ED had various kinds of training. They were board certified or eligible in general pediatrics, in PEM or in GEM. Patients who were evaluated directly by subspecialists were not included in the final analysis because no subspecialist assessed more than 20 patients during the year.

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Procedure

During the study period, patients presenting to the ED were initially registered in the computerized database (Staturg, by Statdev, Montreal, Quebec, Canada) by a designated clerk. This person collected each patient's demographic information, referral status, and mode of transport on arrival. Patients were then triaged by a registered nurse using a computerized version of the Canadian Triage and Acuity Scale (CTAS).[20] Information regarding chief complaints and triage level was registered by the triage nurse. After a variable period, patients were evaluated by a physician. The identity of the physicians providing care and final disposition information were registered by the treating physician in the ED database at the moment of each patient's management. The information was retrieved by the investigators directly from the computerized database. To insure blinding, information regarding physicians' identity was codified and each physician was assigned an identification (ID) number.

Primary Outcome

The primary outcome was admission of a patient to the hospital. This included all patients admitted to the day treatment center or to the ward. In our setting, the decision to admit or discharge a patient is made solely by the emergency physician. At the time of the study, the study setting did not have a short stay unit and, exceptionally, some patients could stay in the ED for up to 12 hours after being seen by a physician (eg, to receive intravenous hydration).

Secondary Outcome

Patients who were discharged from the ED but had an unscheduled visit to the same ED within 48 hours of their time of discharge were evaluated.

Exposure of Interest

Characteristics of each physician were determined by an investigator who knew all physicians working in the ED before analysis. Three characteristics were defined, namely, gender, years of work experience, and medical training. Experience as a physician, defined as the number of years since the physician graduated from residency, was divided into 3 categories to maintain confidentiality of the participants (less than 5 years, 5 to 10 years, and more than 10 years). In the province where the study was performed, a unique ID number is provided at the end of residency. The first 2 numbers of this ID number represent the year of graduation from residency. This number was used to calculate experience. Training was defined as physicians' board certifications. Two physicians were classified as PEM physicians although they were not board certified because of a grandfather clause.

Other risk factors for admission were evaluated as confounding factors.

1. The referral status was defined as self-referral, referral by a physician, and referral by telehealth (patients mentioned at ED registration that they came to the ED after the standardized telephone advices of a nurse).
2. Triage level according to the CTAS was gathered. This is a 5-level triage scale based on chief complaints, vital signs, and secondary modifiers that is mandatory in all EDs in Canada. According to the CTAS, patients triaged level 1 need immediate care, whereas patients triaged level 5 are non-urgent visits.
3. Chief complaints are divided into 35 categories in the computerized database. These categories may encompass patients of variable acuity. These 35 categories were used as categorical independent predictors of outcomes.
4. Arrival by ambulance was measured.
5. Proximity of living was defined as patients with a home postal code located within a 5-km radius of the hospital were considered as living in proximity to the study center hospital.

TABLE 1. Baseline Characteristics of All Patients Evaluated by a Physician in the ED During the Study Period (N = 50,202)

	n (%)
Age category	
<3 mo	3385 (6.7)
3–11 mo	6613 (13.2)
1–2 y	14,572 (29.0)
3–4 y	6340 (12.6)
5–11 y	11,611 (23.1)
>11 y	7681 (15.3)
Season of the visit	
Spring	12,050 (24.0)
Summer	11,444 (22.7)
Fall	13,731 (27.4)
Winter	12,977 (25.8)
Shift of the visit	
Day (8:00–15:59)	24,357 (48.5)
Evening (16:00–23:59)	18,780 (37.4)
Night (0:00–7:59)	7065 (14.1)
Day of the visit	
Regular weekday	34,246 (68.2)
Holiday	1612 (3.2)
Weekend	14,344 (28.5)
Patients living near the hospital (<5 km)	6049 (12.0)
Arrival by ambulance	3770 (7.5)
Referral status	
Self-referred	37,121 (73.9)
Referred by a physician	8323 (16.6)
Consulted the ED after the standardized telephone advices provided by a nurse (telehealth)	4758 (9.5)
Chief complaints	
Vomiting, diarrhea, and abdominal complaint	8645 (17.2)
Trauma	8112 (16.1)
Fever	6781 (13.5)
Fever and respiratory symptoms	6610 (13.2)
Respiratory symptoms	4574 (9.1)
Skin problem	2619 (5.2)
Other	12,861 (25.6)
Triage	
Level 1	530 (1.1)
Level 2	4619 (9.2)
Level 3	18,056 (36.0)
Level 4	23,713 (47.2)
Level 5	3283 (6.5)
Orientation	
Discharge	43,457 (86.6)
Hospitalization	6045 (12.0)
Transfer	702 (1.4)
Return to the ED <48 h	2534/43,457* (5.8)

*Only 43,457 patients eligible because of 6045 admissions and 702 transfers.

6. The shift of the visit was defined as the moment of arrival in the ED as day (8:00 until 15:59), evening (16:00 until 23:59), or night (0:00 to 7:59).

Analysis

All the data were entered into an Excel database (Microsoft Inc, Richmond, Wash) and analyzed with SPSS v17 (SPSS Inc, Chicago, Ill). The 95% confidence interval (CI) was measured for every result.

The admission rates and proportions of unscheduled return visits were calculated for every physician who assessed more than 20 patients. A univariate logistic regression was performed to evaluate the association between hospitalization and the physician's characteristics. Then, a stepwise logistic regression was performed using referral status, triage level, chief complaints, mode of arrival, proximity of home address, and shift of visit as potential confounders. To minimize biases generated by physicians with minimal experience in the emergency setting, secondary analyses were restricted for physicians who evaluated more than 300 patients. Individual admission and unscheduled return proportions were reported for these physicians. Moreover, to encompass the possible confounder related to the fact that PEM physicians may take care of sicker patients, a subgroup analysis was restricted for patients who were not referred by a physician and who were triaged urgent (CTAS level 3) or semi-urgent (CTAS level 4). This latter analysis was restricted to physicians who evaluated more than 300 patients.

Sample Size

Sample size calculation was based on the fact that 10 physicians were needed to assess each risk factor. We estimated that studying all patients visiting the ED for 1 year would provide 50,000 patient visits and 5000 admissions, evaluated by more than 40 physicians.

RESULTS

From April 1, 2008, to March 31, 2009, there were 50,202 children who were evaluated by a physician in the ED. Table 1 describes the baseline characteristics of these patients. Among them, 702 were transferred to another facility or service (such as obstetrics) and were thus not included in the analysis. Also, 354 children were treated by a physician who evaluated less than 20 patients during the year. These children were not included in the analysis leaving a total of 49,146 patients. During the study period, 45 physicians assessed more than 20 patients in the ED. Although PEM physicians represented approximately one third of the physicians, they evaluated more than three quarters of the patients (Tables 2 and 3). Male physicians evaluated more patients per year than their female counterpart as demonstrated by the fact that they evaluated half the patients while representing only one third of the physicians.

There were large variations in admission rates (from 1% to 24%) and proportions of unscheduled return visits to the ED (0% to 11%) for physicians. On simple logistic regression, referral status, triage level, chief complaints, arrival by ambulance, proximity of living, and the shift of visit were all correlated with the probability of admission (data not shown). The 3 physicians' characteristics were also determinants of hospitalization on simple logistic regression. However, on multiple logistic regression, after adjusting for all potential confounders, physicians' gender was not associated with admissions proportions. Physicians with 5 to 10 years of work experience had fewer admissions and those with less than 5 years of experience had the highest hospitalization rate. Also, general pediatricians had a higher proportion of admissions than physicians trained in PEM. As mentioned, unscheduled return rates varied

TABLE 2. Baseline Characteristics of the Physicians (N = 45)

	All Physicians (N = 45) (%)	Physicians Who Evaluated More Than 300 Patients (N = 23) (%)
No. patients seen per physician		
Minimum	22	325
First quartile	82	1207
Median	335	2181
Third quartile	2043	3052
Maximum	4172	4172
Gender		
Female	31 (69)	14 (61)
Male	14 (31)	9 (39)
Experience		
<5 y	8 (18)	6 (26)
5–10 y	9 (20)	4 (17)
>10 y	27 (60)	13 (56)
Specialty		
PEM	16 (36)	15 (65)
Pediatrics	21 (47)	5 (22)
GEM	6 (13)	3 (13)

TABLE 3. Risk Factors for Admission and for Unscheduled Return Visits on Multiple Logistic Regression Adjusted for the 6 Potential Confounders for All Patients Who Were Evaluated by a Physician, Excluding the 702 Patients Who Were Transferred to Another Facility and the 354 Who Were Seen by a Physician Who Evaluated Less Than 20 Patients (N = 49,146)

	No. Patients (%)	Adjusted OR for Admission (95% CI)	Adjusted OR for Return Visit (95% CI)
Female gender	24,464 (49)	0.99 (0.92–1.07)	0.97 (0.87–1.07)
Experience			
<5 y	10,398 (21)	1.27 (1.17–1.38)	1.07 (0.96–1.20)
5–10 y	11,026 (22)	0.82 (0.76–0.90)	1.08 (0.97–1.21)
>10 y	27,722 (56)	1 (ref)	1.0 (ref)
Specialty			
Pediatrics	7800 (16)	1.27 (1.15–1.40)	1.02 (0.89–1.34)
GEM	3088 (6)	1.23 (0.998–1.30)	1.12 (0.94–1.34)
PEM	38,258 (77)	1 (ref)	1.0 (ref)

OR indicates odds ratio.

TABLE 4. Risk Factors for Admission and for Unscheduled Return Visits on Multiple Logistic Regression Adjusted for the 6 Potential Confounders for All Patients Who Were Evaluated by a Physician Who Evaluated More Than 300 Patient Per Year and Excluding the Patients Who Were Transferred to Another Facility (N = 46,404)

	No. Patients (%)	Adjusted OR for Admission (95% CI)	Adjusted OR for Return Visit (95% CI)
Female gender	24,311 (56)	0.97 (0.90–1.05)	0.97 (0.87–1.08)
Experience			
<5 y	7105 (16)	1.29 (1.19–1.40)	1.09 (0.98–1.22)
5–10 y	10,175 (23)	0.83 (0.76–0.91)	1.09 (0.97–1.23)
>10 y	26,079 (60)	1.0 ref	1.0 ref
Specialty			
Pediatrics	5759 (13)	1.36 (1.21–1.51)	1.06 (0.90–1.24)
GEM	2489 (6)	1.25 (1.08–1.44)	1.11 (0.91–1.35)
PEM	35,611 (82)	1.0 ref	1.0 ref

from 0% to 11%. Table 3 shows that there was no statistical association between gender or medical training and the proportion of unscheduled return visits within 48 hours of discharge. Physicians with more than 10 years of experience had a trend toward a lower return rate that was not statistically significant.

To account for the variability engendered by small numbers of patients evaluated, an analysis was restricted to the 23 physicians who evaluated more than 300 patients during the study period. These physicians were mostly trained in PEM and evaluated a median of 2181 patients per year (Table 2). Admission proportions varied from 6.0% to 18.6%, and return proportion varied from 4.4% to 7.0%. Multiple logistic regression adjusted for the 6 potential confounders showed that physicians with 5 to 10 years of experience had a statistically significant lower admission rate than physicians with more than 10 years of experience. The latter had a lower admission proportion than physicians with less than 5 years of experience. Also, pediatric emergency physicians had lower admission rates than the 2 other groups. Finally, gender was not a predictor of admission (Table 4). However, unscheduled returns were not associated with physician gender, experience, or training.

DISCUSSION

This study reports considerable individual variations in hospitalization and unscheduled return proportions for physicians assessing children in a single tertiary care pediatric ED. It shows a statistical association between physicians' years of work experience and outcomes on multiple logistic regression. Also, admission proportions for PEM physicians were statistically lower than for pediatricians or GEM physicians. Although these statistically significant associations seemed weak, they remained significant when restricted to physicians who evaluated more than 300 patients. Finally, this study failed to demonstrate an association between physicians' gender and the risk of admission or return.

This is the first study to compare multiple physician characteristics as determinants of patient hospitalization in a pediatric ED. Our results are comparable to a recent study by Chang et al.[21] In this retrospective cohort study, performed in 2 large hospitals in Taiwan, a very small increase in the proportion of admissions for children evaluated by GEM physicians (10.5%), in comparison to pediatricians (9.1%), was reported. However, all the physicians in the study of Chang et al[21] had less than 4 years of work experience and none of them were PEM physicians. Our results differ from many previous studies comparing treatments or outcomes for children cared for by PEM or GEM physicians.[7–9,22–24] These studies showed that specialty training was associated with differences in test ordering,[7–9,22,24] admission rates,[8,9,23] and cost and length of stay.[7] Our study design differs significantly from these given that we evaluated the management of all types of PEM problems and because all participants were practicing in the same pediatric ED. On multiple logistic regression analysis, physicians with less than 5 years experience had the highest admission rates but had similar rates of unscheduled returns. This result suggests that physician expertise and competence may be more accurate predictors of patient outcome than physician training, as previously hypothesized by Smetana et al[17] and Prentiss and Vinci.[18] This is also in concordance with a study reported by McGillivray et al[25] which concluded that more experienced physicians ordered less tests for febrile children than their less experienced colleagues. Also, 2 studies of pediatric splenic injury management have shown that in individual adult trauma centers, high rates of nonoperative treatment, similar to those achieved by pediatric trauma centers, can be achieved.[26,27] These studies suggested that proper management strategies stem from physician expertise and not solely from training. Our study found no difference in admission or return visit proportions between providers of different genders. Although gender seemed to influence pain management in a previous study,[19] such an outcome may not be comparable to those evaluated in our study.

Our study is the first to report individual physicians' admission and return proportions. Although there was substantial variation for these proportions, this variability remained in a subgroup analysis restricted to similar patients (not referred and triaged CTAS level 3 or 4) evaluated by physicians who saw more than 300 patients per year. These important individual disparities represent a gray zone where medicine balances between art and science. Differences in the treatment of specific illnesses, such as acute otitis media, have already been shown in previous studies in our ED.[28] Such a high variability reflects a lack of standardization of care and may have important impacts on resource use, cost, and patient satisfaction. To standardize patients' management, guidelines have been suggested for several common pediatric problems such as fever or asthma. However, efforts to implement such guidelines have not always been successful.[7,10,22]

LIMITATIONS

Confounding factors could not all be accounted for given the retrospective nature of the study. However, to limit potential confounding by severity, multiple logistic regression, adjusting for referral status, triage level, chief complaints, and other potential

confounders were used. Finally, all data used in this study were prospectively collected by individuals otherwise unaware that this information would be used subsequently in a study.

This was a single center study performed over a single year which may not represent all care provided to children. This would need to be evaluated in a larger multicenter study. In our setting, it is possible that GEM physicians' practices are influenced by their pediatrician colleagues. Furthermore, the single center nature of this study permitted demonstration that, within a given ED, although individual physicians' characteristics may influence admission rates, gender is not a good predictor of patient outcome. Another limitation regards the small number of physicians involved. This limits the power of the subanalysis.

Finally, there is no well-defined target proportion for our primary and secondary outcomes. The admission proportion should be related to the population and may be variable between institutions. Resource availability is another factor which may influence admission. Factors related to the population and setting should, however, be similar for physicians practicing in the same ED.

CONCLUSIONS

Individual physicians had a substantial range of admission proportions for children visiting a single pediatric ED. Physicians' gender does not seem to impact pediatric patients' hospitalization and unscheduled return proportions. Although PEM physicians had a lower proportion of admissions, general pediatricians and GEM physicians had similar admission and unscheduled return rates. Provider experience may be a predictor of such outcomes. Other studies will have to be conducted to identify characteristics of primary care associated with the risk of admission for children visiting the ED. Also, the variability in admission proportions suggests that there is room for improvement to standardize the care of pediatric patients in the ED.

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