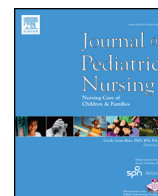




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Predicting Pediatric Emergency Severity Index Level Based on Emergency Department Pre-Arrival Information

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ABSTRACT

Purpose: This study examines the use of phone referral information to predict Emergency Severity Index triage levels as a proxy to anticipate emergency department nursing resource allocation in a pediatric hospital. It also assesses the relationship between these pre-arrival triage levels and hospital admission.

Design and Methods: Emergency nurses with specialized training used standardized phone referral information to assign triage levels to 481 patients before their arrival. Upon patient arrival, independent triage levels were assigned. The two levels were then compared and patient disposition was collected. Descriptive statistics and Cohen's kappa were used to assess agreement between the two emergency severity index levels.

Results: Moderate agreement was found between the pre-arrival and arrival triage levels. The majority of patients (71.3%) with a pre-arrival triage level of 1 or 2 (the most acute levels) were admitted to the hospital. These patients were also more likely to be admitted to the intensive care unit than were patients with a pre-arrival triage level ≥ 3 .

Conclusions and Practice Implications: The ability to predict triage levels for incoming patients could give the emergency department charge nurse the ability to plan ahead so that appropriate nursing staffing is available upon arrival. The knowledge that patients assigned a pre-arrival triage level of 1 or 2 are more likely to be admitted gives the emergency department the ability to plan for bed placement and inpatient nursing resources earlier, potentially resulting in decreased emergency department length of stay. More study on these potential benefits is needed.

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Introduction

Emergency departments (EDs) often receive referral calls from outside providers ahead of time to alert them that patients are coming to be evaluated and treated. Understanding these pre-arrival patients' severity status and likely need for resources would potentially be helpful in allocating appropriate nursing staffing.

Triage levels are assigned to patients arriving to EDs indicating the patient's clinical status and anticipated resources as a means to

prioritize the patients presenting for care. Emergency nurses also use triage levels for approximating the number of required interventions, balancing patient assignments, and standardizing the frequency and timing of assessments.

The Emergency Severity Index (ESI) is a commonly used, validated triage leveling tool typically assigned at the time of patient arrival to the emergency department (Dateo, 2013; Gilboy, Tanabe, Travers, & Rosenau, 2011; Green et al., 2012; Worster, Sardo, Eva, Fernandes, & Upadhye, 2007). In a recently published study, it was found that prediction of ESI by physicians using emergency medical services (EMS) referral information was only fairly reliable (Williamson, Gochman, Bullaro, Kaufman, & Krief, 2017). There are no studies to date evaluating emergency nurses' assignment of ESI levels for pre-arrival patients and it is unclear if ESI level can be accurately determined based on phone referral information from multiple referral sources.

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The purpose of this study was to determine the ability of emergency nurses to predict ESI levels for pre-arrival patients based on phone referral information and to assess the relationship between the predicted pre-arrival ESI level and ultimate patient disposition.

Methods

Design

A prospective single group exploratory study was conducted with ESI levels determined by emergency nurses before the patient's arrival and again at the time of arrival.

Setting and Sample

This study was conducted in the emergency department of a pediatric tertiary care center with an average of approximately 38,000 patients per year. In this emergency department, patients can be called in ahead of their arrival to the ED Communication Center located within the emergency department. This center fields an average of 6308 calls a month and takes referrals from primary care providers, internal subspecialties, outside hospitals, and EMS on an average of 1441 patients a month. The patients' referral information is taken in a systematic and standardized way by ED Communication Specialist Nurses (CS RNs). CS RNs are practicing emergency nurses with at least two years of emergency nursing experience. The majority of CS RNs who participated in this study (30/34) had more than five years of experience. They also had received at least 24 h of additional training in taking referral calls and ensuring that complete and appropriate information is obtained from referring providers. This process ensures continuity of care with the referring provider and allows the ED care teams to anticipate patients who are en route, and plan accordingly. At the time of the study, an average of 33% of the ED daily census consisted of patients for whom pre-arrival information was taken, and 43% of these patients went on to be admitted to the hospital.

During the study period August–October 2014, patients called into the ED Communication Center were eligible to be included in the study. Exclusion criteria included: patients who were called in by family members, referred by fax, or who had not seen a healthcare provider within the last 24 h.

Human Subjects Protection

This study was reviewed and found to have no more than minimal risk to human subjects and was approved by the institutional review board.

Measures

The ESI is a frequently used triage tool in ED care. It uses a standard algorithm to assign acuity levels taking into account if the patient is at high risk (using the patient's presenting problem and medical history), level of consciousness, vital signs, and number of anticipated interventions needed during emergency care. The levels range from ESI Level 1, which is assigned to patients who require immediate life-saving interventions, to ESI Level 5, which is assigned to low acuity patients who are predicted to need no interventions (Gilboy et al., 2011). In previous studies, ESI Version 4 has been found to be a valid, reliable tool with good inter-rater reliability (Dateo, 2013; Green et al., 2012; Worster et al., 2007). The reliability of the tool in pediatrics was found to be moderate when studied in emergency departments that see both adult and pediatric populations (Travers, Waller, Katznelson, & Agans, 2009). In addition, it has been found to be a valid predictor for hospital admission (Green et al., 2012). In this study, pre-arrival ESI levels were assigned based on phone referral information including: reported clinical status, vital signs, and anticipated resources. A second

independent ESI level was assigned upon arrival as per current standard of care and was based on nursing assessment of clinical status, vital signs, and number of anticipated interventions.

Procedure

To assure a standard level of competency on the ESI Version 4, ED nursing staff (including CS RNs) completed an online pediatric specific training module followed by a 25-question post-test.

During the study period, the CS RNs assigned a pre-arrival ESI level to a convenience sample of 500 patients called into the ED Communication Center. The information taken into account when making the assignment included: reported health history, history of present illness, reported clinical status/physical exam, interventions, vital signs and/or referring provider recommendations. The pre-arrival information was printed, the ESI level handwritten on it, and the form securely stored.

Emergency nurses continued the standard practice of assigning each patient an ESI level upon arrival. The pre-arrival ESI was blinded from the nurse assigning the arrival ESI level and the two levels were always assigned by different emergency nurses. Patient pre-arrival and arrival ESI levels were collected, as well as basic patient demographics and disposition.

Data Analysis

Descriptive statistics were calculated for all patient characteristics. There were low numbers of patients with pre-arrival ESI levels 1 and 5 (four patients and one patient, respectively). Therefore, the levels were recoded into a second binary variable that combined pre-arrival ESI levels 1 and 2 and levels 3, 4, and 5. The split was done at that point for clinical reasons, as ESI levels <3 need immediate or time sensitive intervention and levels ≥ 3 are deemed safe to wait for ED services.

To examine the agreement between the pre-arrival and arrival ESI levels, the Cohen's weighted kappa and associated 95% confidence intervals were calculated (Fleiss, Cohen, & Everitt, 1969). This was done for the ESI levels 1–5, as well as for the binary ESI levels.

The relationship between the predicted pre-arrival ESI level and patient disposition was assessed using a Cochran–Armitage Trend Test. Significance testing was completed at $\alpha = 0.05$ level. All analyses were carried out using SAS statistical software version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

There were 500 patients enrolled in the study. A total of 19 (3.8%) mental health patients were excluded from the analyses because in this emergency department, these patients are automatically assigned an ESI level of 2. A total of 481 patients were included in the analyses.

Table 1 contains a description of the sample characteristics of the patients ($N = 481$) enrolled in the study based on the binary pre-arrival ESI levels assigned. Patient age and gender did not differ significantly between the binary pre-arrival ESI levels. Referring provider type and patient disposition differed significantly between the assigned binary pre-arrival ESI levels ($p < 0.001$). Approximately half of patients in both ESI level groups were referred by an outside hospital and both groups had approximately 6% of patients referred by EMS. The pre-arrival ESI groups differed in referrals coming from primary care (14.4% in the <3 Group vs. 32% in the ≥ 3 Group) and subspecialty care (29.8% in the <3 Group vs. 10.3% in the ≥ 3 Group). Differences were also noted in patient disposition, with more than half of patients with a pre-arrival ESI level ≥ 3 being discharged compared to 28.2% of patients with a pre-arrival ESI < 3. The mean [SD] pre-arrival ESI level was 2.64 [0.54]. The arrival ESI level was similar with a mean [SD] of 2.66 [0.59].

Analysis found moderate agreement (Landis & Koch, 1977; Sim & Wright, 2005; Viera & Garrett, 2005) between the pre-arrival and arrival

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