

Predicting Subsequent High-Frequency, Low-Acuity Utilization of the Pediatric Emergency Department

Margaret E. Samuels-Kalow, MD, MPhil, MSHP; Matthew W. Bryan, PhD;
Kathy N. Shaw, MD, MSCE

From the Department of Emergency Medicine, Massachusetts General Hospital, Boston, Mass (Dr Samuels-Kalow); Department of Biostatistics and Epidemiology (Dr Bryan), Department of Pediatrics (Dr Shaw), Perelman School of Medicine at the University of Pennsylvania, Philadelphia, Pa; and Division of Emergency Medicine, The Children's Hospital of Philadelphia, Philadelphia, Pa (Dr Shaw)
Conflict of Interest: The authors declare that they have no conflict of interest.
Address correspondence to Margaret E. Samuels-Kalow, MD, MPhil, MSHP, Department of Emergency Medicine, Massachusetts General Hospital, 0 Emerson Place, Suite 104, Boston, MA 02114 (e-mail: Msamuels-kalow@partners.org).
Received for publication June 16, 2016; accepted November 12, 2016.

ABSTRACT

OBJECTIVE: To derive and test a predictive model for high-frequency (4 or more visits per year), low-acuity (emergency severity index 4 or 5) utilization of the pediatric emergency department.

METHODS: The study sample used 3 years of data (2012–2014) from a single tertiary-care children's hospital for patients <21 years of age. Utilization in 2013 defined the index visit; prior utilization was drawn from 2012; and 2014 was used for outcome measurement. Candidate predictor variables were those that would be available at the time of triage. Data were split into derivation and test sets randomly; variables with a significant univariate association in the derivation set were included for multivariable modeling. The final model from the derivation set was then tested in the validation set, with calculation of a receiver operating characteristic curve.

RESULTS: There were 90,972 visits in 2013, of which 61,430 were first (index) visits. A total of 590 (1%) had 4 or more triage

level 4 or 5 visits in the following year (2014). The final model included site of primary care, age, acuity, previous utilization, race, and insurance, and had an area under the receiver operating characteristic curve of 0.84.

CONCLUSIONS: Data available to the emergency department provider at the time of initial visit triage can predict utilization for low-acuity complaints in the subsequent year. Future work should focus on validation and refinement of the model in additional settings, and electronic calculation of risk status for targeted intervention to improve appropriate utilization of health care services.

KEYWORDS: emergency department; low-acuity; predictive model; utilization

ACADEMIC PEDIATRICS 2017;17:256–260

WHAT'S NEW

Prior retrospective studies have found conflicting risk factors for high-frequency, low-acuity emergency department (ED) utilization. This study focused on identifying risk factors, identifiable at the patient's initial visit, that predict subsequent high-frequency ED utilization, as a first step toward intervention.

MULTIPLE STUDIES HAVE identified that patients with frequent, low-acuity, utilization of the emergency department (ED) account for a disproportionate amount of health care resources. In one study, using data from children's hospitals that submit data to the Pediatric Health Information System, children with 4 or more ED visits per year (of any acuity) represented 8% of the cohort but 24% of visits and 31% of costs.¹ Patients with frequent utilization, particularly infants without a chronic medical condition, were the least likely to require medications, testing, or hospital admission.¹ Another pediatric study, conducted in 2 EDs, found that those

with frequent low-acuity utilization of the ED represented <2% of all patients but almost 10% of all visits.²

A variety of risk factors for high-frequency utilization, and high-frequency, low-acuity utilization in particular, have been described. Socioeconomic vulnerability, chronic disease, and high utilization of other health care services³ were associated with frequent ED use in adults. A recent large Pediatric Emergency Care Applied Research Network study found that repeat visits to the pediatric ED were associated with younger age, black or Hispanic race or ethnicity, and public insurance.⁴

However, interventions to address patterns of frequent low-acuity utilization have been limited by our inability to prospectively identify patients at risk during their ED visit. Ideally, one would be able to identify those patients at risk of developing a pattern of high-frequency, low-acuity utilization and target appropriate interventions at them before the high-cost, low-efficiency period of use has taken place.

The goal of this project was to derive and test a predictive model for high-frequency, low-acuity utilization, using

only variables available at the time of ED triage, to enable identification of these patients for timely intervention. The eventual goal of this project is to create a model that could be part of the electronic medical record (EMR) to automatically flag patients at risk of future high-frequency, low-acuity visits. This would enable the efficient testing of interventions such as improved linkage to primary care, case management, or referrals to address unmet social needs to determine what combination of intervention is most effective.

METHODS

DATA

The study sample was generated from 3 years of data from the EMR 2012–2014 at a single tertiary-care children's hospital. The first year of data (2012) was used for a description of prior ED utilization. The second year (2013) was used as the index year. Demographic data, such as age and insurance status, was abstracted from the first visit in 2013. The third year (2014) was used for outcome measurement, during which the frequency of high-frequency, low-acuity utilization was measured. This structure reduces the potential for seasonal variation or misinterpretation of utilization patterns within a single year of data. We chose to use utilization in the subsequent calendar year, rather than 365 days after the initial visit, to avoid confounding by a single episode of care and examine a patient's broader pattern of utilization. The protocol was approved by the Children's Hospital of Philadelphia institutional review board (14-011300).

SUBJECTS

Patients were excluded if they were older than 21, as many patients have transitioned to a general ED setting at that point, and those continuing to receive care at a pediatric center represent a population that is more likely to have significant underlying chronic disease. To be included in the final model, patients had to have nonmissing values for all variables.

VARIABLES

Candidate predictor variables were identified on the basis of a review of the literature for variables that would be available to an ED provider at the time of triage and were vetted by the 72-hour revisit quality improvement committee at our institution. They were as follows: in-network primary care in the year preceding the index visit; in-network specialty care in the year preceding the index visit; gender; age; acuity; season; utilization in prior year; race; insurance; shift of presentation; and day of week. In-network primary or specialty care was a binary variable indicating any visit to a primary or specialist within our health care system at any point in the EMR history. Prior utilization was defined as the number of visits of any acuity level in the preceding year (2012). Because of the known difficulty in distinguishing "nonemergency" ED visits from a presenting complaint,⁵ we chose to define a low-acuity visit as one as-

signed an emergency severity index (ESI) triage level 4 or 5. High-frequency, low-acuity utilization was defined as 4 or more triage level 4 or 5 visits in the outcome year (2014). We chose to use more than 4 visits to be as consistent as possible with previous definitions,^{1,4} because we are attempting to identify the children who are going to develop the most problematic patterns of utilization to maximize opportunities for early intervention.

ANALYSIS

The data were randomly split into a derivation set and a validation set, with 50% of patients in each group. In the derivation set, univariate associations were identified between candidate predictor variables and high-frequency, low-acuity utilization. Variables with a significant ($P < .05$) univariate association on chi-square testing were included in an initial multivariable logistic regression model in the derivation set. The model was refined using a backward stepwise process. Likelihood ratio tests were used to compare candidate models. The model from the derivation set was then tested in the validation set, with calculation of a receiver operating characteristic (ROC) curve. Analyses were conducted by Stata 13.1 software (StataCorp, College Station, Tex).

RESULTS

There were 90,972 visits in 2013, of which 61,430 were index visits. After excluding patients who were >21 years of age or who had unknown gender or triage scores, there were 60,799 visits. Of those, 590 (1%) had 4 or more triage level 4 or 5 visits, thus meeting our definition of high-frequency, low-acuity utilization. The maximum number of visits in 1 year was 29. Among the patients without high-frequency, low-acuity utilization, the top 5 chief complaints were respiratory distress (15.2%), trauma/extremity (10.7%), other (7.4%), trauma/face/head/torso (6.6%), and abdominal pain (5.6%). Among those with high-frequency, low-acuity utilization, the top 5 chief complaints were respiratory distress (27.3%), fever (17.5%), rash (7.1%), vomiting (6.8%), and other (4.8%).

Table 1 shows the cohort demographics for the entire cohort and unadjusted associations with utilization for the derivation set. The following variables had a significant ($P < .05$) association on chi-square testing and were included in an initial multivariable logistic regression model in the derivation set: in-network primary care; in-network specialty care; age; acuity; utilization in prior year; race; and insurance. In the final model, presence of in-network care, younger age, lower acuity index visit, previous high utilization, black race, and government insurance or self-pay were associated with high-frequency, low-acuity utilization (Table 2). The performance of the final multivariable model was then tested in the validation set with calculation of an ROC curve (Fig) with an area under the curve (AUC) of 0.84 (95% confidence interval, 0.81–0.86). Using an empirical cut point estimation yields an optimal cut point of 0.0997 (AUC 0.78), with a sensitivity of 0.77 and a specificity of 0.78 (Table 3).

Download English Version:

<https://daneshyari.com/en/article/5716995>

Download Persian Version:

<https://daneshyari.com/article/5716995>

[Daneshyari.com](https://daneshyari.com)