10 Boarding Psychiatric Patients in the Emergency Department is Associated With Increased Emergency Department Violence

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Study Objectives: The national shortage of available inpatient psychiatric beds has led to many emergency departments (EDs) boarding patients on involuntary psychiatric holds for hours to days. Psychiatric holds absorb ED resources, consume beds that could be used for other acute care patients, and often delay adequate psychiatric treatment. Our study sought to determine if ED psychiatric holds also contribute to increased violence in the emergency department. A secondary objective was to determine if other variables, such as weather or proximity to the first day of the month (when financial assistance funds arrive), could predict ED violence. Staff hypothesized that more assaults occur toward the end of the month as some patients desire their holds revoked around the time of monthly financial support distributions.

Methods: When an assault on staff occurs an overhead code is called and logged. We reviewed 1 year of these logs and compared them to logs showing the number of psychiatric holds in the department, the maximum temperature and occurrence of rain on a given day, whether a given day was in the first or last 10 days of a month, and the total ED census of a given day. The hospital is an urban level 2 academic trauma center and regional referral center in southern California that sees 120,000 patients per year.

Results: Between May 1, 2016 and April 30, 2017, 297 assaults resulting in an overhead code call occurred in the hospital with 57 of them in the ED. 94% of the ED assaults occurred during days with 4 or more patients on a hold, compared with 6% on days with 3 or fewer holding patients ($p<0.04$). A logistic regression analysis that included the number of holds (4 or greater versus less than 4), the maximum daily temperature, the total ED census, whether rain occurred on a given day, and the 10-day period of the month (early versus late) showed 2 significant associations. Having more psychiatric holds (4 or more) predicted assault, even with total ED census controlled ($p=0.02$), and more assaults occurred in the last 10 days of the month than the first 10 ($p=0.03$). Weather patterns were not associated with assaults.

Conclusions: Increased boarding of psychiatric patients in the ED is associated with increased assaultive behavior, demonstrating another adverse impact of psychiatric patient boarding. Weather failed to predict assaults but as predicted more assaults occurred toward the end of the month.

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11 In an Emergency, Get Fined for Being Fine: Accuracy and Insurance Policy to Retrospectively Deny Emergency Department Coverage Based on Discharge Diagnoses

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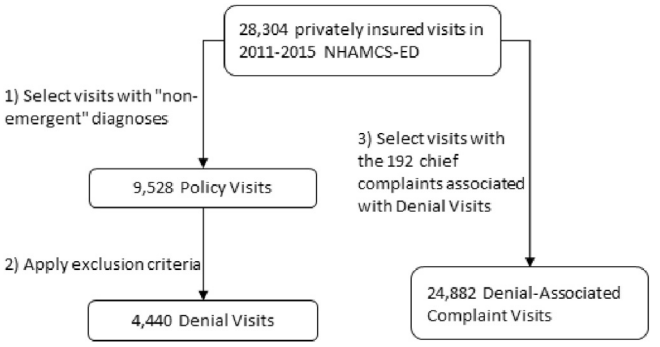
Study Objectives: Public and commercial insurers have increasingly sought ways to reduce emergency department (ED) visits. Anthem Inc., a large national insurer that covers 1 in 8 Americans, recently began denying coverage for ED visits if the final visit diagnosis was among a pre-specified list of "non-emergent" diagnoses. The insurer implemented this policy in 6 states and is expanding to others. We examine the impact to ED patients if all commercial insurers adopt similar policies of retroactive coverage denial for emergency care.

Methods: We performed a cross-sectional, stratified analysis of a nationally representative sample of ED visits from the 2011-2015 National Hospital Ambulatory Medical Care Survey ED sub-sample. We included ED visits by patients aged 15 to 64 years with commercial insurance and classified them into 3 non-exclusive cohorts for stratified analysis (Figure). First, "policy visits" were the ED visits with a "non-emergent" diagnosis in accordance with Anthem's policy. Second, "denial visits" were the subset of policy visits that could be denied coverage after we applied the exclusion criteria specified by the insurer, such as hospital admission. Third, "denial-associated complaint visits" were the ED visits with the same presenting chief complaints as the denial visits.

Results: Between 2011 and 2015, 21.9% (95% confidence interval [CI] 20.9-22.9) of all U.S. ED visits, representing 29.6 million visits annually, were made by commercially insured adults. Of these ED visits, 34.0% (95% CI 32.9-35.0), or 10.1 million (95% CI 8.8-11.3) visits annually, were policy visits, of which 35.5% (95% CI 32.4-38.7) were triaged as urgent or emergent, 42.9% (95% CI 40.8-45.0) received 2 or more diagnostic tests, and 5.4% (95% CI 4.6-6.2) were hospitalized or transferred. After applying exclusion criteria to policy visits, 15.7% (95% [CI] 15.0-16.4) of all included ED visits remained as denial visits, representing 4.6 million (95% CI 4.1-5.2) visits annually, of which 24.5% (95% CI 21.7-27.4) were initially triaged as urgent or emergent and 26.0% (95% CI 23.8-28.3) received 2 or more diagnostic tests. These denial visits had the same presenting chief complaints as 87.9% (95% CI 87.3-88.4) of all U.S. commercially insured adult ED visits, representing 26.0 million (95% CI 23.1-28.9) denial-associated complaint visits annually. Of these visits, 43.2% (95% CI 40.2-46.4) were triaged as urgent or emergent, 51.9% (95% CI 50.0-53.9) received 2 or more diagnostic tests, and 9.7% (95% CI 8.8-10.6) were hospitalized or transferred.

Conclusions: "Non-emergent" diagnoses correlate poorly with visit severity and the need for multiple diagnostic testing and hospital care. Furthermore, since patients present with symptoms, not diagnoses, nearly 9 in 10 ED patients may be at risk of coverage denial for their ED care. If commercial insurers begin adopting similar policies and retrospectively deny coverage for ED visits using discharge diagnoses, patients will be forced to weigh the odds of foregoing potentially necessary care against the risk of facing significant financial burden if they guessed wrong.



12 Predicting Patients at Risk for Leaving Without Being Seen Using Machine Learning

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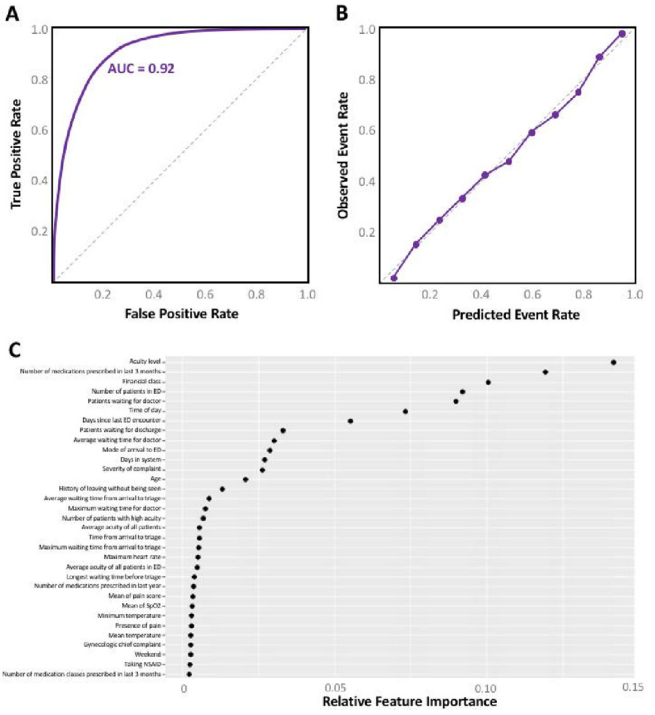
Study Objectives: Patients who leave without being seen (LWBS) remain a persistent challenge for emergency departments (ED). It results not only in sub-optimal patient care and medicolegal risk but LWBS is also publicly reported and has revenue implications both in terms of lost encounters and as a CMS quality measure (OP-22). Patients who leave without being seen (LWBS) are a persistent problem in the emergency department. Patients who leave the emergency department without being seen by a health care provider contribute to delays and ED cost but neither benefit from health care nor provide reimbursement for the encounter. Many different strategies have been proposed to reduce LWBS including having greeters meet patient on ED arrival, physician triage/rounding in the waiting room, presenting patients with estimates of waiting time, and providing reassurances to patients as they wait. One of the greatest challenges is identifying the particular patients at highest risk for LWBS.

Methods: We retrospectively analyzed a cohort of patients seen in a large urban academic medical center emergency department. We used electronic health record (EHR) data that would be available at the time of patient triage in the ED including chief complaint, vital signs, prior diagnoses and comorbidities,

medications, prior labs, and history/pattern of previous health care utilization. Additional features included demographics, time of day, and date. We utilized gradient boosting (xgBoost), an ensemble machine learning approach, in which a large number of weak learners are iteratively combined together into a single strong learner. 10x cross validation was used for testing. A dashboard for EHR integration was developed to facilitate display of real-time predictions at time of ED presentation.

Results: The machine learning models were trained on 3 years of data from 1/1/2015 to 1/10/2018 spanning 217,150 encounters for 113,400 patients. The overall LWBS rate was 4.42%. After 7 iterations of development, the xgBoost model achieved an AUC of 0.92 (Figure A) with good calibration (Figure B) an 79% accuracy, 89% sensitivity, and 79% specificity. The most important features (Figure C) included time of day, acuity, insurance type/status, chief complaint, utilization history, and medications. This represents the best model published to date to predict patient level risk of LWBS.

Conclusions: We demonstrate the feasibility of using machine learning to accurately identify patients at risk for LWBS using only data available at time of triage. We also described a method for surfacing that information into the ED work stream. Prospective validation will be necessary to determine how effectively this prediction can be combined with intervention strategies to reduce LWBS and improve patient experience.



EMF 13 Is Hospital Performance on Publicly Reported Quality Measures Associated With Patient Outcomes?

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Study Objectives: Measuring and reporting on process quality measures has become ubiquitous in health care, and the emergency department (ED) is no exception. How well process measures that focus on ED care correlate with subsequent patient outcomes is unclear. We used process measures that were publicly reported to the Centers for Medicare and Medicaid Services Hospital Compare program and sought to determine how performance on those measures correlated with mortality rates.

Methods: We examined the following measures relevant to ED care in 2013-2015 for patients with acute myocardial infarction (AMI): percentage of patients receiving aspirin (ASA) at arrival, percentage of patients receiving primary percutaneous coronary intervention (PCI) within 90 minutes of hospital arrival, median time to ECG for patients with chest pain and median time to transfer to another hospital with for PCI. We grouped hospitals into 3 groups: the bottom 25% of measure performance, the middle 50% of performance and the top 2% of performance. Using linear regression, we calculated risk-adjusted 3-, 7-, 14-, and 30-day mortality rates for ED admissions for AMI among continuously enrolled Medicare beneficiaries age 65 and older using the Medicare inpatient and denominator files from 2013- 2015. We incorporated patient age, sex, and chronic conditions as covariates. We ran these models separately for each measure.

Results: The study sample consisted of 4,481 hospitals, of which 54.1% reported on the ASA measure, 54.4% on ECG, 33.9% on PCI, 13.8% on timely transfer for AMI. The mean hospital performance scores for each measure by performance group are presented in Table 1. When comparing risk-adjusted mortality across these groups we found no significant association between hospital performance on process measures for AMI and patient-level AMI mortality (N= 421,795 ED AMI admissions) at any time point for any of the measures (30-day mortality presented in Table 2).

Conclusions: We found no evidence that hospitals performing better on most publicly reported ED process measures had better outcomes for patients with AMI. Policymakers should carefully consider if the effort associated with reporting process measures is justified.

Table 1. Mean Performance Score by Hospital Performance Group

	Bottom 25% of Hospitals	Middle 50% of Hospitals	Top 25% of Hospitals
ASA at arrival	89.8%	97.7%	100%
PCI within 90 minutes	88.4%	97.2%	100%
Time to ECG	15.1 min	7.7 min	3.7 min
Time to Transfer	101.6 min	55.1 min	35.5 min

Table 2. Adjusted 30-Day Mortality Rate for AMI by Hospital Process Measure Performance Group

	Bottom 25% of Performance	Middle 50% of Performance	Top 25% of Performance	P-Value
ASA at arrival	14.3%	14.9%	14.6%	0.41
PCI within 90 minutes	12.8%	13.0%	12.8%	0.97
Time to ECG	14.6%	14.5%	14.8%	0.47
Time to Transfer	16.6%	16.2%	15.6%	0.16

Adjusted mortality among continuously enrolled Medicare beneficiaries age 65+

14 Results of 20 Machine-Learning Techniques to Identify Sepsis Patients in the Emergency Department

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Study Objectives: The expeditious identification of patients with sepsis is a ubiquitous priority to facility early recognition and appropriate management. Many computer-based clinical decision support (CDS) tools have been