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Predicting Hospital Admissions to Reduce Emergency Department Boarding

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Abstract

Recent research has established that Emergency Department (ED) congestion is often caused by the inability to transition patients into inpatient units within the hospital in a timely fashion. This problem, in which the ED boards inpatients, is common across the U.S. Predicting ED patient admission using demographic and clinical information with only a few admission predictor factors investigated so far. We have developed a prediction model that can be used as a decision support tool and help reduce ED boarding. Using secondary data from the ED of a local hospital, we have examined the importance of eight demographic and clinical determinant factors of ED patients' admission to the hospital. We have employed Logistic Regression (LR) and Neural Network (NN) modeling techniques and based on our statistical analysis, we have identified encounter reason, age, and radiology exam type as the most significant factors. We have studied patterns between input variables (i.e. age) and output variables (i.e. admitted or not) and have developed a set of rules of thumb for predicting admissions. These unique rules can be used without any modeling or further investigation during operations, therefore providing important information regarding the ultimate status of a patient after ED operations without any time or cost. The study proves that an admission prediction model based on demographic and clinical determinant factors can accurately estimate the likelihood of patient admission, thus decreasing ED boarding and congestion, both significant problems in hospital operations.

Key words: Emergency Operations, Admission, Prediction Model, Regression, Neural Networks

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1. Introduction

The problem of lengthy patient wait times due to overcrowding in emergency departments (EDs) has gained significant attention in recent years (Kelly, 2004; Olshaker and Rathlev, 2006; Hoot and Aronsky, 2008; Paul et al., 2010; Hodgins et al., 2011), with studies reporting ED overcrowding throughout the United States (Patrick, 2011). Recent research has established that ED congestion is often caused by the inability to transition patients into inpatient units within the hospital in a timely fashion (Fatovich et al., 2005).

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