RESEARCH TOPIC CLI10

AI-Enhanced Intervention to Reduce Emergency Department Revisits within 9 Days of Discharge

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Abstract

Background: Previous studies have shown that emergency department (ED) revisits of patients recently discharged are common and costly, and may be an indicator of poor healthcare quality. Studies on the frequency and causes of ED revisits have yielded varying results depending on the timeframe examined (1-3). ED revisits within 72 hours were frequently due to illness-related causes (4) and patient-related factors (1). Additionally, misdiagnosis, suboptimal management and inadequate patient education were common contributing factors to avoidable revisits (4, 5). This highlights the need for improved diagnostic accuracy, care coordination, and management strategies to reduce the incidence of ED revisits and improve patient outcomes. Recent studies have suggested using a 9-day timeframe since the 72-hour metric misses close to 70% of returning patients (6, 7). However, there is still limited data and conflicting results regarding the frequency and causes of these events. In recent years prediction models utilizing machine learning algorithms were developed to identify the essential factors that contribute to patients' revisits to the ED. However, most of those studies focused on the 30-day timeframe (8-10). The ability to predict the probability of a patient revisiting the ED can assist healthcare providers with better decision-making, deliver improved patient outcomes while ensuring efficient utilization of ED resources.

This study aims to evaluate the frequency and underlying causes of emergency department (ED) revisits within 9 days of discharge over a 10-year period. Using AI technology, retrospective data will be analyzed to uncover patterns and factors associated with these revisits. The next study phase focuses on developing an AI-powered scoring system to effectively identify patients at higher risk of ED revisits within 9 days of discharge. This scoring system will aid in making appropriate discharge decisions and implementing strategies to prevent unnecessary ED revisits. The final phase involves a prospective study to validate the effectiveness of the developed score in reducing ED reentry for high-risk patients. This phase will assess the utility of the AI-based score in accurately identifying patients who require additional interventions or care pathways to prevent ED revisits. Overall, this study aims to enhance patient outcomes and reduce unnecessary ED revisits through AI-guided decision-making.

Objectives:

- Phase 1: Retrospective Study
  - o Utilize AI algorithms to retrospectively evaluate the frequency and underlying causes of ED revisits within 9 days of discharge over a 10-year period.
  - o Identify key factors associated with these revisits and their impact on healthcare utilization and patient outcomes.
- Phase 2: Score Development
  - o Develop an AI-based scoring system using machine learning techniques to predict the likelihood of ED revisits within 9 days of discharge, based on the findings from the retrospective study
  - o Incorporate relevant patient characteristics, medical history, and other factors to create a comprehensive risk assessment tool.
  - o Integrate the scoring system into the discharge decision-making process to identify high-risk patients requiring additional interventions.
- Phase 3: Prospective Study
  - o Validate the effectiveness of the developed scoring system in a prospective study setting.
  - o Implement the scoring system for real-time risk assessment of patients prior to discharge.
  - o Assess the impact of AI-guided interventions, such as targeted care pathways and follow-up appointments, on reducing ED revisits within 9 days of discharge.
  - o Evaluate patient outcomes, including healthcare utilization, patient satisfaction, and overall quality of care.

Study Design and methods

- Retrospective data collection: The study population will include all nonsurgical patients discharged from the Humanitas Research Center medical wards or ED over a 10-year period (January 1, 2012 - December 31, 2021). Data will be extracted from the hospital's electronic health record system. Patients who returned to the ED within 9 days will be identified. Patient demographics, and clinical data such as triage level, patient-in time, patient-out time, ED or hospital length of stay, chief complaint, first and second discharge diagnoses, and disposition after the second visit to the ED will be extracted from the health records. The causes of ED revisit will be classified as being the result of factors pertaining to the illness, patient, and/or physician.
- Retrospective analysis: Utilize AI algorithms to analyze the retrospective data and identify factors associated with ED revisits within 9 days of discharge.
- Score development: Develop an AI-based scoring system using a combination of predictive modeling and machine learning techniques. The insights gained from the retrospective study will be utilized to construct a prediction model. This model will identify the key factors that significantly influence patients' revisits to the ED within 9 days of discharge, utilizing advanced machine learning techniques. Candidate risk factors will be evaluated using univariable and multivariable analyses in a training cohort to identify variables that are significantly associated with ED revisits. Those variables will then undergo

further multivariable analysis and the selected variables will be included in the final multivariable model for construction of the risk prediction model which will estimate the probability of ED revisit within 9 days of discharge. Training and validation cohorts will be used to assess the effectiveness of our score with regard to its discrimination, satisfactory calibration, and clinical applicability.

- Prospective data collection: Enroll eligible patients and collect data prospectively, including demographic information, medical history, risk scores, follow-up plans.
- Prospective analysis: Implement the scoring system in real-time to identify high-risk patients, and assess the effectiveness of AI-guided interventions in reducing ED revisits within 9 days of discharge.

Statistical Analysis: Descriptive statistics will be used to summarize the data. Categorical variables will be presented as frequencies and percentages, while continuous variables will be presented as means and standard deviations. The incidence of ED revisits will be calculated. Multivariate logistic regression analysis will be performed to identify ED revisits predictors.

Ethical Considerations: This study will be conducted in accordance with the principles of the Declaration of Helsinki. The study protocol will be approved by the Humanitas Research Center's Institutional Review Board. Patient confidentiality will be maintained throughout the study. Informed consent will be obtained from participants involved in the prospective study.

Scientific references

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Type of contract

Position not supported by any scholarship or equivalent contract.

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