Abstract

# Predictive Modeling of Emergency Hospital Transport Using Medical Alert Pattern Data: Retrospective Cohort Study

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## Abstract

**Background:** In the transition from a fee-for-service to a fee-for-value system, health care organizations (HCOs) are under pressure to keep patients healthy through preventive services and population health management. Predictive analytics based on the past health behavior of the patient population can be used to predict future risk of decline.

**Objective:** The objective of this study was to develop robust predictive models of impending emergency transports to the hospital based on enrollment and medical alert pattern data from subscribers of a Personal Emergency Response System (PERS) service. This enables targeting of clinical programs to members that need it the most.

**Methods:** De-identified medical alert pattern data of 551,127 subscribers to a PERS service were used. Multivariate logistic regression was performed on subscriber demographics, self-reported medical conditions, variables related to the care giver network and variables derived from up to one year of retrospective medical alert data. A 10-fold cross-validation scheme was used to predict transport to the hospital by emergency medical services in the next 30 days. Furthermore, the model performance was evaluated after retraining using up to 90 days of medical alert data, and using enrollment data only.

**Results:** Emergency hospital transport in the 30-day window was experienced by 2.4% of all subscribers. The area under the receiver operator characteristic curve (auROC) was 0.75 ± 0.01 in the validation cohorts. The model using up to 90 days of data resulted in auROC = 0.71 ± 0.01 and the model using enrollment data only resulted in auROC = 0.62 ± 0.01.

**Conclusions:** Our model for emergency hospital transport in subscribers of a medical alert service showed good discriminatory accuracy on retrospective validation data. While the model yields good discriminatory accuracy with up to 90 days of data, best performance is achieved using up to one year of medical alert data. The model using enrollment data only, without medical alert pattern data, does not perform as well. We are planning a prospective validation of the algorithm to determine the value of the predictive model in assisting HCOs with planning early interventions to avoid emergency department visits and hospitalizations.

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**KEYWORDS**

care coordination; data analysis; emergency medical services; personal emergency response service; population health management; predictive modeling

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## Multimedia Appendix 1

Extended abstract.

[PDF File (Adobe PDF File), 739KB-Multimedia Appendix 1]

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