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Title: Role of Artificial Intelligence for Self-Triage Systems of Safe Increase of Ambulance Resource Efficiency

Tanveer Ahmed Yadgir[1], Tamas Madl[2], Omer Al Sakaf[3]
[1]Fatima College of Health Sciences
[2]HeartShield Ltd
[3]Dubai Corporation for Ambulance Services

Abstract

Aims and Objectives: Existing prehospital triage systems have limited accuracy in the absence of physiological measurements prior to arriving at the scene. This study proposes two new computerized models in a prehospital self-triage, based on information available to patients themselves, investigates safety and accuracy in terms of under- and over-triage rates, and compares them with established scores such as the Modified (MEWS) or National Early Warning System (NEWS) and the Emergency Severity Index (ESI).

Design: This was a retrospective cohort study used artificial intelligence for data evaluation. Data from patient calls to Ambulance Services in the time from 2012 to 2016 used to evaluate prehospital triage systems. Outcomes analyzed by comparing established scores and the two proposed models with records of clinical impressions provided by paramedics on-site.

Results: Among the 433,498 calls, 18.8% classified as serious and 4.1% life threatening. Data-driven and interpretable self-triage models, based on a Bayesian rule list (RL) and decision tree (DT) classifier, showed better discriminative power between serious and non-serious calls compared to established scoring systems, with a sensitivity of 99.5% (RL) / 98.3% (DT) and negative predictive value of 98.6% (RL) / 97.0% (DT). Compared to physiological scoring systems with sensitivities of 98.0% (MEWS), 74.7% (NEWS), 51.8% (ESI) and negative predictive values of 82.6% (MEWS), 90.2% (NEWS), and 84.7% (ESI). The safest model (RL) has the potential to reduce current call load by 10.0%, without misclassifying any life-threatening emergencies, at only 0.5% risk of misclassifying potentially serious calls, and an order of magnitude less under-triage compared to existing scores; potentially facilitating higher safety and lower cost at the same time. The RL model is easily interpretable and extensible, only requires a few verbal questions (requiring only a smartphone- no diagnostic devices needed), and can be applied to unconstrained verbal patient complaints.

Conclusion: We present supporting evidence for the feasibility, safety, and utility of high-sensitivity patient self-triage systems derived using computational methods, without requiring

either training or diagnostic devices. To encourage further validation, we make the full models freely available.

Keywords: self-triage, ambulance triage, priority dispatch accuracy, artificial intelligence

ORCID ID: 0000-0001-8427-5834