

**Utilizing a machine learning mortality model to increase serious illness conversations in hospitalized patients:
A cluster randomized controlled trial**

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Background. Patient-physician communication about prognosis, values, and preferences can help to ensure that the care patients receive is concordant with their goals and improve the quality of care in serious illness. However, fewer than a third of patients near the end of life, or their families, recall a discussion on prognosis with their physician. In part, this is because physicians overestimate their patients' prognosis and are often not able to identify patients who are near the end of life. Therefore, to encourage physicians to initiate these conversations with seriously ill patients, we used a machine learning model to identify patients at high risk of mortality, and we notified their physicians that a conversation was indicated.

Methods. We use a validated machine learning model to identify patients admitted from the emergency room who were at high risk of death in 30 days (Positive Predictive Value (PPV) 0.252) and 6 months (PPV 0.561)). The machine learning model uses patient history and pre-admission features, including patient's prior encounters, diagnosis codes, problem lists, procedures, medications, orders, laboratory values, to predict the likelihood of a patient dying during an inpatient stay, within 30 days of admission, and within 6 months of admission. We use a single site cluster randomized controlled trial design to measure the impact of a notification on serious illness communication and subsequent outcomes. Intervention physicians (n = 37) receive an email and page notification for admitted patients at high risk of death, which encouraged them to have a serious illness conversation and to document that conversation in the electronic health record (EHR). Physicians randomized to control (n = 36) do not receive a notification and continue to provide standard of care. Our primary outcome is serious illness conversation documentation in the EHR during the hospital admission; documentation is measured by use of an EHR template specific to serious illness conversations. Our secondary outcomes include patient change in code status to do not resuscitate, palliative care consultation, discharge to hospice, and 30-day and 6-month mortality. Descriptive statistics of preliminary data were calculated.

Results: In the first six months of the randomized controlled trial, 190 patients (72 control and 118 intervention) were identified as high risk of death out of an expected sample size of 360 patients. Patients were 76 (SD 12.3) years old, 54.2% female, 57.4% Caucasian, and 93.2% non-Hispanic. Ninety-seven patients (51.1%) had documented serious illness conversation in the EHR. For secondary outcomes, 36 (18.9%) patients had a change in code status to do-not-resuscitate, 24 (12.6%) had a palliative care consultation during the hospitalization, 25 (13.1%) were referred to hospice, and 46 (24.2%) died within 30 days of admission.

Conclusion. It is feasible to implement a machine learning mortality model to notify clinicians of patients at high risk of mortality and measure relevant health care outcomes. Future work will report results of the randomized trial and expand this notification process to encourage serious illness conversations in other inpatient subspecialties settings.