DESIGNING AN INPATIENT ONCOLOGY EARLY WARNING SYSTEM FOR FUTURE IMPLEMENTATION

Hospitalized patients are at high risk for clinical instability: about 4% of general hospital ward encounters progress to transfer to the intensive care unit (ICU) or death, and this risk increases to 9% for oncology inpatients. Additionally, such deterioration is frequently presaged by unrecognized abnormal vital signs or lab results hours before overt decompensation. For these reasons, there is great interest in leveraging electronic health record data to predict which patients will deteriorate in order to prompt earlier interventions which could prevent or mitigate instability. However, despite theoretical appeal, early warning systems (EWS) for general ward patients have not consistently demonstrated improved patient outcomes or processes of care.

Broadly, my research investigates the reasons underlying the unmet potential of EWS in order to identify and address gaps in both knowledge and practice. For instance, standard EWS currently produce many false alarms in general inpatient populations while failing to accurately identify patients at risk in oncology cohorts. An EWS designed specifically for oncology patients – who also have unique needs and risk factors related to their malignancies, treatments, and complications – has yet to be described. Thus, my colleagues and I designed an oncology-specific EWS (the Onc-EWS), which displays a higher positive predictive value and greater accuracy than existing EWS.

However, further gaps remain in this area. First, it is unclear to what extent key stakeholders, including users and beneficiaries, have been involved in prior EWS design; full stakeholder involvement is important to ensure that potential barriers and facilitators are addressed for implementation and appropriate utilization. Second, the Onc-EWS – derived and validated in a sample of patients from 3-5 years ago – must also be validated in contemporary patients because of recent changes in case mix, novel therapies, and our hospital’s electronic health record. In this KL2 application, I will address these gaps by (1) using a mixed-methods approach informed by a validated implementation science framework to explore stakeholder perspectives regarding Onc-EWS factors, and (2) validating the Onc-EWS in a contemporary cohort of oncology patients.

In the first Aim, I will use an evidence-based implementation science framework for health information technology to create, administer, and analyze a survey of clinician, nurse, and patient stakeholders of the Onc-EWS in order to characterize their perspectives on usability, barriers, and facilitators. Subsequently, I will perform semi-structured interviews with a subset of these stakeholders to obtain a diversity of detailed perspectives on these topics. I will accomplish this work while mentored by experts in mixed-methods research, implementation science, risk communication, and clinical oncology and critical care.

In the second Aim, I will create a static dataset of contemporary oncology inpatient data to evaluate the discrimination (ability to distinguish observations with and without an event, measured by the area under the receiver-operator characteristic curve [AUROC]) and calibration (agreement between predicted probability and true probability of event, measured by model intercepts and slopes) of the Onc-EWS in this subsequent sample, performing model recalibration or revision as indicated by statistical testing. Guiding my progress and learning for this Aim will be mentors in biostatistics and epidemiology, risk prediction modeling, and clinical informatics.

These aims will allow me to (1) refine and finalize the design and (2) move towards implementation and clinical testing of an accurate EWS for oncology patients, while (3) attending to stakeholder priorities from model-building through implementation.