Analytic Interventions Unit (AIU): Evaluating and Implementing Machine Learning Models to Improve Patient Care

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Problem

Machine learning (ML) is a rapidly developing area of technology that has great potential to improve the quality of care for our patients and ease of practice for providers. However, it is essential to select topics and interventions that will have a real impact, and to ensure that the models we use are safe and accurate for our patient population. Furthermore, models can have unintended bias that leads to inequitable care, so reviewing them with an equity lens is essential. Whether a model is internally developed or sourced from an external vendor, UChicago Medicine must ensure it is the right tool for the job.

Goal

In 2019 UChicago Medicine created the Analytic Interventions Unit (AIU), an interdisciplinary group of data scientists, IT specialists, and clinicians, to support the building, validation, implementation, and ongoing monitoring of ML models in clinical care spaces. The AIU works with stakeholders who have a model and intervention plan in mind, and takes the model through the entire process from idea to reality. If a model does not pass validation, the AIU works with the stakeholder to understand why and evaluate potential solutions.

Example: Risk of Re-Hospitalization Model

John Fahrenbach (Data Scientist) developed a ML model to predict the risk of re-hospitalization for patients with a UCM Primary Care Provider who have been discharged from the hospital (inpatient or observation) at 30, 60, and 90 days. The model is based upon EHR data from each patient's health condition, behavioral health factors, social health factors, and hospitalization history.

Fahrenbach, with Megan Bracamontes (Ambulatory Care Coordinator) and Annemarie Guinane (Senior Manager of the Ambulatory Care Coordination Team), created a Tableau dashboard that draws from the models to stratify patients based on risk levels. Ms. Guinane uses this dashboard to refer patients to ambulatory care coordinators, who reach out and set goals with patients to avoid re-hospitalization.

Example: Epic No Show Model

Epic offers a suite of ready-made ML models, including one that predicts the risk of ambulatory appointment no-shows.

During AIU’s initial validation, the out of the box model did not perform well on the UCM patient population and was re-trained with UCM patient data and for in person visits only before implementation. Upon post-implementation review, it became evident the model was not equally accurate across different specialty areas. The AIU communicated with Epic and is re-evaluating the model with plans to adjust it further with additional UCM data. The model will be ready for re-deployment after AIU and the Epic team collaborate to make necessary changes to improve performance.

Based on initial validation, it was determined that overbooking was not an appropriate intervention based on the accuracy of the results. Instead, the first intervention will be additional automated communication with patients at highest risk of no-show.

Conclusions

Machine learning models are not one-size-fits-all, and each model needs to be evaluated to show that it works well for UCM’s patient population and for its intended intervention. The higher the risk that an intervention carries (e.g. surgery), the more accurate the model needs to be, and likewise with interventions that may have unintended consequences for equitable care (e.g. overbooking).

Even after a model is implemented, many factors can change: the way data is recorded in Epic, the demographics and health conditions of the patient population, the way the model’s results are used. The AIU does not stop after initial validation or implementation; ongoing monitoring is necessary to maintain the quality of the results.

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