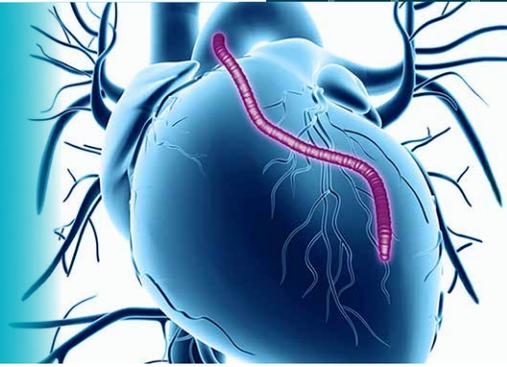


Decreasing Readmission Rates for CABG Patients Through Predictive Modeling

Advanced machine learning combined with clinical and business understanding leads to a practical solution for Michigan-based medical center.



The Challenge

Unnecessary readmission is a serious challenge for hospitals discharging patients who have recently undergone Coronary Artery Bypass Graft (CABG) surgery. Readmissions can be costly in terms of time, labor, insurer payouts, and reputation. In fact, the Centers for Medicare & Medicaid Services (CMS) penalizes hospitals for 30-day readmissions. While some readmissions are due to medical complications, many can be avoided by interventions either at discharge or through post-operative monitoring.

Although the medical field has developed metrics for predicting readmission – for example, the LACE method – these methods are not data-driven, nor particularly effective.

The Solution

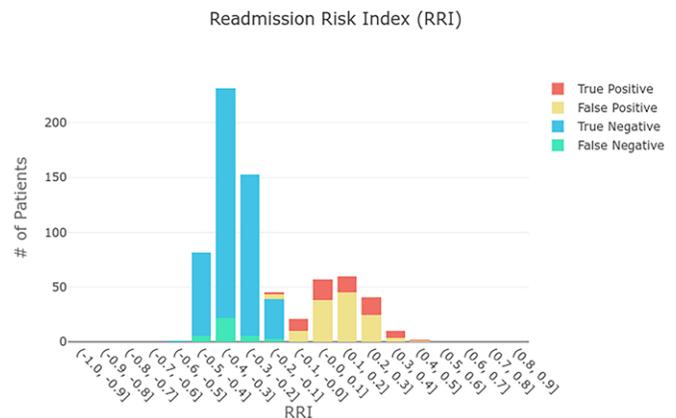
4th-IR collaborated with a cardiac team at a medical center in Michigan, U.S.A., to develop a far more accurate predictive model. The 4th-IR team combined advanced machine learning with a deep understanding of clinical and business issues to create a model that more than doubled predictive accuracy. The model was not only more accurate, it was also intuitive to use – delivering information in an easy-to-understand format. The model then became a powerful tool in creating better procedures for discharged cardiac patients – procedures that protected patients and reduced costs and risks.

Machine Learning Meets Process Reengineering

Solution development began with meeting with the medical team to understand the medical challenges they were facing and the healthcare and business implications of CABG patient readmission for the medical center. Any solution would need to address both clinical and business concerns as defined by the center’s subject matter experts.

Training the predictive model

The 4th-IR team studied CABG cases performed at the center over a 2-year period. Approximately 12 percent of these patients had been readmitted. Not only was this costly to the medical center, it was not always the best care option for the patient.

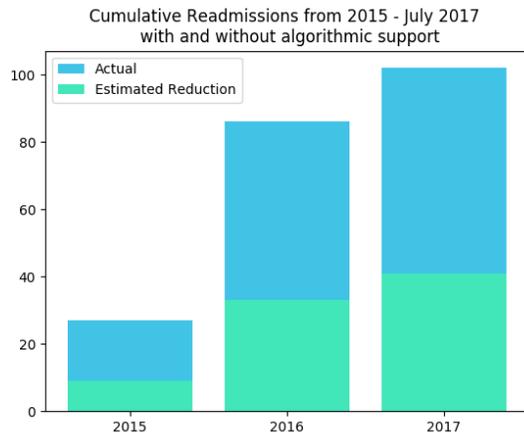


The 4th-IR team created a Readmission Risk Index by training a set of world-class algorithms to learn readmission predictor patterns with insights gleaned from the data set. The goal was to reduce false positives – but without missing true positives – a dilemma facing most models. The team addressed the complexity of the challenge by factoring in approximately 70 different patient traits. Using two predictive models in tandem, the team was able to achieve the desired ratio of true positives to false positives.

“By far more accurately predicting CABG patients who were at high risk for readmission, we could increase quality of care and the quality of life of our patients, and at the same time reduce costs for the medical center.”

- Medical Center Project Lead

The 66 percent accuracy would have prevented a majority of the patients from being unnecessarily readmitted in the timeframe of the data set studied. In addition, the model gave the medical team a far better ability to track patients who truly were at risk to be readmitted. Better healthcare. Better business.



Intuitive Interactive Tools for Smarter Decisions

4th-IR first developed a web-based slider tool that showed the distribution and the balance between false positives and false negatives, given different patient variables. The balance between false positives and false negatives impacts business decisions and the associated costs of incorrectly deciding to readmit or not. In the background was a complex set of statistical models feeding the tool. All the medical team needed to know, however, was the predicted balance that would help them weigh costs, logistics and patient health.

The 4th-IR team developed a customizable iPad app that enables a clinician to generate a readmission risk score at the time of discharge. The app not only shows if the patient is high-risk for readmission, it also gives the top five contributors to their risk score. This allows the clinical team to adjust follow-up procedures based on the patient's risk profile.

Next Steps: Intelligent Ecosystem Improves Care and Controls Costs

Based on recent successes in predicting CABG readmissions, the 4th-IR team continues to enhance the solution set to identify readmission precursors and opportunities for proactive remediation of readmissions. The end result is not just a predictive model, but an entire intelligent ecosystem.

In addition to risk identification from the data currently being explored, the 4th-IR team is incorporating telehealth monitoring equipment to track specific bio-metric functions. For example, tracking weight gain can predict pulmonary fluid retention, catching one of the most common conditions leading to readmission before it becomes an emergency. The ecosystem applies cutting-edge artificial intelligence for monitoring the healing of the surgical incisions and sutures via image detection. Incorporating multiple data sources, including smart devices and patient-entered data, into a highly tailored descriptive patient model allows physicians to deliver better healthcare, and administrators to reduce costs and risks.

Further, the infrastructure to monitor patients and assess risks for CABG procedures can be used to monitor and assess other readmission challenges. The tools developed for this project are being re-applied throughout the hospital, buttressing the medical center's risk reduction and precision medicine and quality of care.

“4th-IR focused on patient outcomes and the specific business needs of the medical center. The combination of an easy-to-use technology solution and reengineered processes is increasing quality of care and strengthening our business model. It may sound clichéd, but they delivered more than a product. They delivered a solution.”

- Medical Center Project Lead



4th-IR combines machine learning with business and healthcare expertise to develop practical technology solutions that enable healthcare organizations to deliver premium care while enhancing their bottom line.