

Nurse Satisfaction and Experience Using a 30-day Readmission Predictive Analytics Tool in a Military Treatment Facility Patient Centered Medical Home

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Introduction

Unplanned hospital readmissions have a negative impact on quality measures and patient satisfaction scores, as well as an overall impact on resource consumption (Amarasingham, et al., 2013). Key to success in reducing 30-day readmissions is the accurate and timely identification of individuals at highest risk (Kripalani, et al., 2014). A myriad of variables, both known and unknown, contribute to an individual patient's risk of readmission (RoR) (Joynt, 2012). Big data analytics can determine which findings are consistent across the operational continuum and which are limited to specific military groups, cohorts, locations, or time periods (Sushmita, et al., 2016).

Madigan Army Medical Center, a military treatment facility (MTF) in Tacoma, Washington collaborated with a private machine learning firm, KenSci, Inc. to develop and operationalize an all-cause RoR tool for clinical use. This tool utilizes KenSci's machine learning (ML) platform on premises and is fully integrated into the workflows of the Cardiology Clinic and the Internal Medicine Clinic Patient Centered Medical Home (PCMH).

Background

In summer 2017, a team of clinic nurses began using the ML-based predictive RoR tool to assist in the triage and chronic disease management of patients at high risk for all-cause 30-day readmission following hospital discharge. The tool was first piloted within the MTF's Cardiology Clinic workflow for one Heart failure (HF) nurse in June 2017 and subsequently disseminated to the larger Internal Medicine Clinic (IMC) PCMH for implementation by additional nursing staff (N=6 nurses).

The Risk of Readmission Tool

The 30-day all-cause Risk of Readmission (RoR) tool predicts a patient's likelihood of rehospitalization based on real-time and historical electronic health record data. The tool ingested data directly from the Department of Defense (DOD) structured, large-scale data warehouse containing over 20,000 input variables. Along with these, Madigan Army Medical Center (MAMC) patient data from current and historical encounters, including vital signs, laboratory values, and diagnostic codes, were combined with derived features, such as length of inpatient stay, served as inputs which were aggregated during the inpatient admission. Using these data points, the KenSci platform provided machine learning (ML) model outputs to the Madigan SQL interface and ultimately to the Madigan Internal Medicine and Cardiology Clinics. The clinic nurses received individual patients predicted RoR scores integrated into their normal workflow panel of inpatients. Risk scores for each patient were color-coded as high risk, moderate risk, and low risk. The data was refreshed once per day (Figures 1 & 2). The predictive risk scores were utilized to enhance population health management to reduce rehospitalizations among the targeted clinic populations.

Figure 1. Madigan Data & Model Output Flow



Aim

The study intended to explore, qualitatively, the satisfaction and user experience with RoR tool to determine the extent to which nurses utilized the tool in clinic settings. Also, to identify if resulting interventions and workflows were developed and potentially adjusted to answer the research question, "Does the evaluation of the end-user experience with the risk of readmission tool provide evidence of its dynamic use and value in nursing practice?" The desired outcome of this study is to improve quality of patient care and add to the nursing knowledgebase.

Prior Research

Our work to evaluate the impact of a predictive tool on nurses' satisfaction builds on that of Jeffery et al. (2017). In their work, the authors utilized a participatory study design which serves as the first step towards developing probability-based decision support tools for nurses (Jeffery, Novak, Kennedy, Dietrich, & Mion, 2017). While the authors assert that the value of clinical decision support tools, in general, is widely recognized, gaps remain in understanding interactions between probability-based predictive analytics tools. Our research targets determining levels of satisfaction and specific clinical workflows and interventions resulting from the use of a predictive analytics clinical decision support probability-based application, such as the RoR tool, with a focus on mathematical probabilities. As while increasingly utilized, the tools have not received sufficient attention regarding their influence on nursing behavior.

Methods

A Naturalistic qualitative approach for an inquiry into the IMC and Cardiology nurses' use of the tool, was utilized to explore nurse experience in their clinic settings. This method is grounded in the development of context-specific statements about the multiple, constructed realities of all the key participants (Frey, Botan, & Kreps, 1999). It is used to directly elicit results that are narrative and subjective (Polit & Beck, 2008), in this case, from the nurses using the RoR tool in the Cardiology Clinic and IMC PCMH.

Figure 2. 30-Day All-Cause Risk-of-Readmission (RoR) Tool Output



Qualitative Approach

A free-text form including the following exploratory statements about their experience with the RoR tool to obtain qualitative study results was given to 6 Internal Medicine Clinic nurses and 1 Cardiology Clinic nurse. Statements were collected post-RoR tool implementation to provide insight on the nurses' practices derived from the use of the tool.

Qualitative Exploration

1. Description of specific workflows resulting from RoR tool use.
2. Description of specific interventions resulting from RoR tool use.
3. Description of recommendation(s) if any, for refining of interventions resulting from RoR tool use.
4. Description of recommendation(s) if any, for refining of workflows resulting from RoR tool use.
5. Description of recommendation(s) if any, for revision of RoR tool.
6. Description of any additional lessons learned resulting from the use of the RoR tool.

Qualitative Results

Workflows Developed & Recommended Revisions

According to the Internal Medicine Clinic nurses, the RoR tool became a valuable resource for them to obtain a list of risk-stratified inpatients. The RoR tool supported existing IMC team workflows, including that upon patient discharge, nurses made patient follow-up appointments – complying with NCQA PCMH standards where all follow-up appointments are within three days of discharge - either face to face encounters or telephone consults, per direction of inpatient provider. No recommendations for revisions to workflows in the IMC clinic were identified.

Several daily workflows were enhanced in the Cardiology Clinic as a result of the RoR tool. They included highlighting high-risk patients for members of the care teams, including those from both the Cardiology Clinic and Inpatient Wards and advocating for and coordinating care for patients enrolled to the VA. Also, facilitating care between inpatient and outpatient wards for patients with HF, and scheduling close follow-up appointments upon discharge for patients who meet the HF criteria. One particularly telling recommendation from the experience of using the RoR tool in the Cardiology Clinic was to make the tool available to all Inpatient Wards, Primary Care Clinics, and Specialty Care Clinics.

Interventions Developed & Recommended Revisions

In the Internal Medicine Clinic, one specific intervention resulting from the use of the RoR tool was that patients identified as high risk of readmissions were added to the nurse team's patient management list. At the time of the study, there were no recommendations to refine interventions as a result of the use of the RoR tool.

In the Cardiology Clinic, there were several specific enhancements developed as a result of the use of the RoR tool. These included facilitating communication among care teams; coordinating plans of care for patients, managing patient populations, specific to heart failure; providing one-on-one nurse education and coordinating and facilitating Heart Failure group classes for patients with new onset of HF. Two recommendations to refine interventions resulting from the use of the RoR tool included training personnel in the inpatient wards to use the tool and resources available throughout the facility to improve timely diagnoses, documentation, and coding.

Recommendations for Tool Improvements

The Internal Medicine Clinic nurses made many recommendations to revise the RoR tool. Feedback included:

- identify drivers of the patients' RoR Scores (e.g., diagnoses, procedures, and medications)
- include network admissions and diagnoses
- display the date patients were last seen in the Primary Care Clinics
- continue to refine model accuracy and reliability

The Cardiology Clinic nurse recommended several revisions for the RoR tool. The suggestions were to:

- direct the nurse to patients' charts when clicking on the risk score
- add the ability to print detailed patient information, including medical history and admissions, on a single page
- add filter options and identify the drivers of patients' risk score, (e.g., diagnoses, procedures, and medications)
- continue to improve model accuracy and reliability
- provide historical data

Discussion

According to the Internal Medicine Clinic nurses, the Risk of Readmission tool was seamlessly incorporated into the workflow of the Patient Centered Medical Home (PCMH) Teams. Through the use of the RoR tool, clinics improved the coordination of care, enhanced workflows and interventions, and efficiently managed patients at risk for readmissions. The integration of the RoR tool enriched processes and interventions already established at the IMC PCMH. The RoR tool decreased the number of information systems needing to be accessed to obtain such data and facilitated the identification of patients not seen in the IMC in past year and assisted with the prioritization of visits to inpatient wards.

The Cardiology Clinic nurse reported that the RoR tool helped bridge the gap between inpatient and outpatient services and allowed nurses to have an ongoing working knowledge of patients admitted. To improve this further, this nurse stated that universal access to the RoR tool throughout all clinics would further enhance communication among care teams and help mitigate breakdowns in transitions to outpatient care. Upon the description of lessons learned, the Cardiology HF nurse stated, "all nurses need data to make a difference in how we identify patients for all chronic conditions to provide proactive versus reactive care."

Conclusion

Reducing 30-day inpatient readmissions can be realized by the accurate and timely identification of individuals at highest risk. A machine learning-based 30-day Risk of Readmission predictive tool for nurses' clinical use, the first of its kind in the MTF-setting, was developed, operationalized and integrated into the workflow of a Patient Centered Medical Home (PCMH) within internal medicine clinics and the cardiology clinic.

The implementation of the predictive analytics 30-day Risk of Readmission tool:

- assisted nurses in the identification of patients at risk for 30-day hospital readmissions
- aided nurses' facilitation of effectual chronic disease management workflows for at-risk HF patients
- increased communication regarding at-risk patients among nurse and ancillary team members
- contributed to the overall care coordination of the patient population within the PCMH
- improved timely clinical and technology-related workflows and nursing inventions during utilization

The collaboration between a military treatment facility and healthcare informatics company empowered nurses to make recommendations for refinements related to workflows and nursing interventions to improve quality of care. In addition, nurses were provided the opportunity to suggest enhancements to the predictive RoR tool itself, ensuring improved usability and reliability in the future.

Contribution to New Knowledge

Population Health Management strategies to improve transitional care from the inpatient setting to Patient Centered Medical Home's clinics can be realized through the use of a predictive analytics 30-day readmission tool for all patients. Users reported improved chronic disease management by interdisciplinary teams working in a large MTF. Nurses identified, developed and implemented patient-centered workflows and interventions to reduce patient readmissions and improve the health of their patients and communities, as a result. Nurses can successfully use predictive tools such as the RoR tool to make data-based recommendations, aimed at improving patient care and quality outcomes.

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