

Executive Summary

Clinical Decision Support with Audit and Feedback for Prevention of Acute Kidney Injury in Cardiac Catheterization



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Project Overview

Phase I: Resource Development

To develop, test usability, and refine risk prediction / decision support tools and an audit and feedback process for AKI integrated using the APPROACH clinical information system. The team worked with medical leads for each site to develop agreed upon procedural approaches for AKI reduction for high-risk patients.

Phase II: Implementation

To deploy a provincial (Foothills Medical Centre, Royal Alexandra Hospital, and University of Alberta Mazankowski Alberta Heart Institute) intervention, using a stepped-wedge design. Education and training was provided to all staff regarding AKI risk stratification, prevention protocols and follow up care prior to their adoption of the intervention, to facilitate uptake.

Phase III: Evaluation

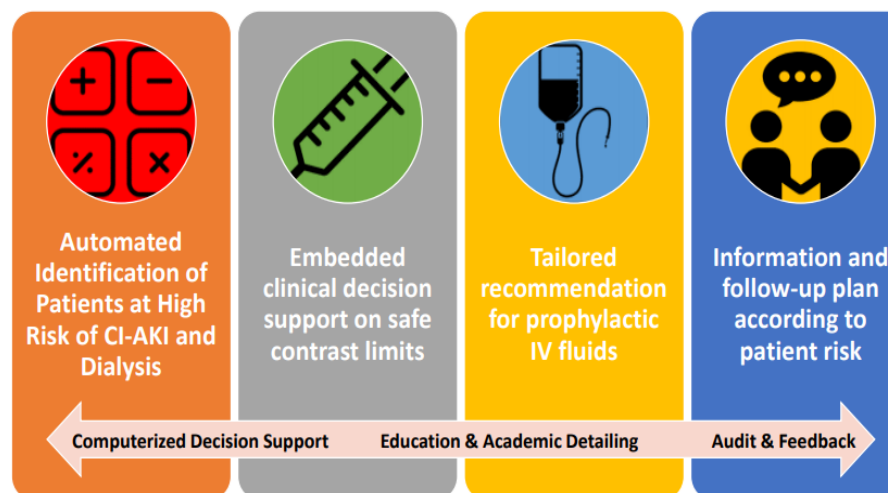
To evaluate the effect of the initiative on the incidence of AKI, post-procedural bed days per patient managed, cardiovascular and kidney outcomes, and costs.

What is the issue?

Acute kidney injury (AKI) is a common and expensive complication of heart procedures, including coronary angiography and percutaneous coronary intervention. There are accurate ways to identify patients at high risk for developing AKI and to prevent this complication. These include minimizing the volume of contrast dye used, and optimizing the use of intravenous fluids. However, these interventions may be neglected if care teams do not recognize high risk patients. Preventable cases of AKI contribute to longer hospital stays, hospital readmissions, and even the need for dialysis in some cases - all of which contribute to unnecessarily high costs of health care. Quality improvement initiatives have been shown to prevent 1 in every 5 cases of AKI after a heart procedure. This project was designed to determine whether implementation of a multifaceted intervention for AKI prevention is effective in the health care system in Alberta. Preventing 1 in every 5 cases of AKI after a heart procedure in Alberta, could lead to a savings of \$1.4 million dollars in yearly health care costs for the province.

What is the aim of this project?

The purpose of this project was to implement strategies that make it easier to identify high risk patients and prevent AKI in cardiac catheterization labs in Alberta. The project systematically implemented four key evidence-based strategies to reduce the risk of AKI and mitigate its consequences on patient outcomes and costs of care. Targeted education, point-of-care computer-based clinical decision support, and audit and feedback were used to deliver these strategies into clinical practice.



Implementation

Implementation Sites:

All cardiac catheterization units in Alberta (Foothills Medical Centre, Royal Alexandra Hospital, and University of Alberta Mazankowski Alberta Heart Institute).

Implementation Design:

The deployment of the intervention was carried out in a staged manner, following a stepped-wedge design that sequentially added random groups of cardiologists to the intervention, through an academic detailing session to a new group of 2-6 cardiologist every 8 weeks, and including each of the 34 eligible physicians who performed diagnostic and therapeutic cardiac procedures in Alberta..

Implications in the Lab:

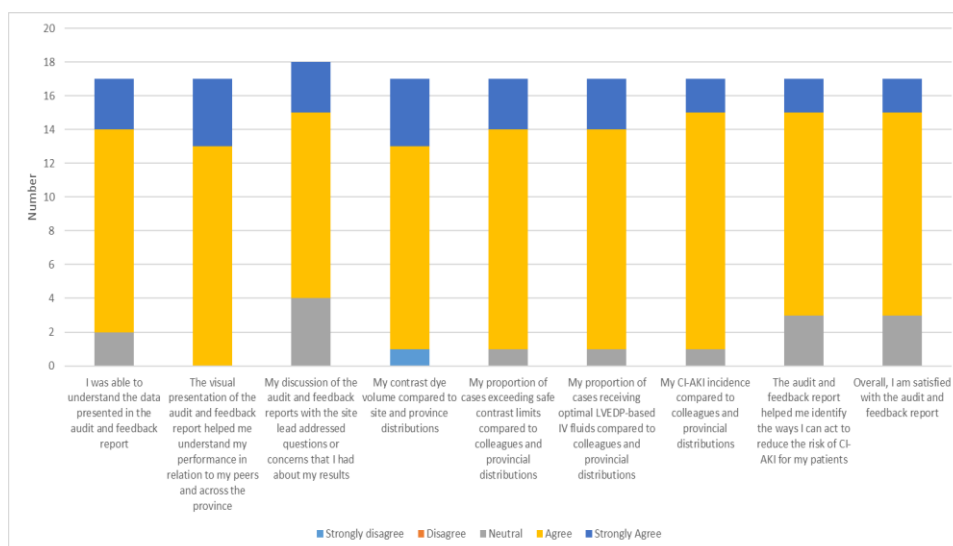
Once education and training was provided to a physician they began receiving safe contrast limit calculations and LVEDP based fluid recommendations, to facilitate uptake. Throughout the project processes of care and clinical events were tracked using the APPROACH system and provincial laboratory data to measure and report back to physicians their use of appropriate AKI prevention strategies (i.e. remaining within contrast dye safety limits and using hemodynamically optimized IV fluids), and AKI incidence.

How was the project implemented?

A cluster-randomized, stepped-wedge trial, with all invasive cardiologists randomized to various start dates for the intervention between January 2018 and September 2019. Following implementation, the AKI risk prediction model was completed in over 90% of eligible patients before their procedure.

What has been the impact on physician practice?

Usability and satisfaction with decision support tools and audit and feedback reports were formally evaluated and used to inform revisions and deployment of these tools. Subsequent audit and feedback reporting cycles incorporated new recommendations and feedback from interventional cardiologists, leading to the inclusion of more specific process-of-care guidance, targets, and presentation refinements to increase the efficiency of reviewing the reports by cardiologists.



The majority of end-users indicated that reports supported comparisons between colleagues, and that audit and feedback has informed behaviour changes consistent with the recommendations provided by the decision-support tools.

What has been the impact on patient experience?

The initiative included standardized AKI risk assessment, followed by guidance delivered to patients at risk of AKI accompanied by communication to primary care providers to improve continuity of care when patients care transitioned from the hospital to the community. A survey of participants at increased risk of AKI found

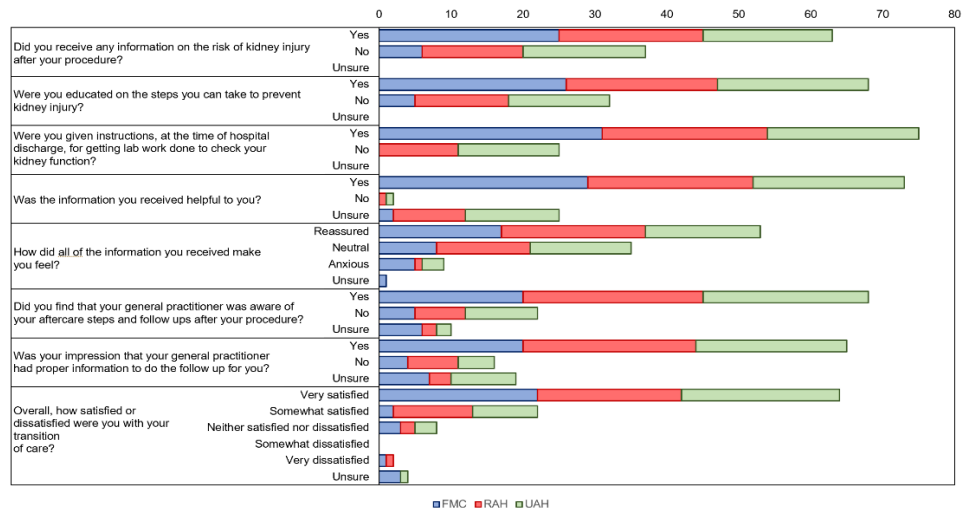
Audit and Feedback Reports

The data collection processes introduced by the initiative have been used to implement a continuous audit and feedback (A&F) system to report performance and outcomes according to patient risk status for each interventional cardiologists in Alberta, measure adherence to the protocol, and provide feedback to physicians and unit managers to improve consistency of care.

What is included in the A&F

- Reports were provided quarterly
- Individual physician data alongside aggregate, anonymized group-data for peers at the same hospital and for all participating physicians.
- Site-specific comparisons minimize external factors that may affect physician performance, such as differences in available procedural resources and patient clinical or demographic characteristics, whereas province-wide comparisons may expose relevant underlying institution-level differences that affect patient care and outcomes.
- Since research suggests that A&F is more effective when provided in writing and verbally, A&F reports were delivered by the site lead at all three sites to facilitate verbal discussions of feedback and suggested behavioural changes.

that implementing these processes was associated with positive patient experiences and satisfaction with care.



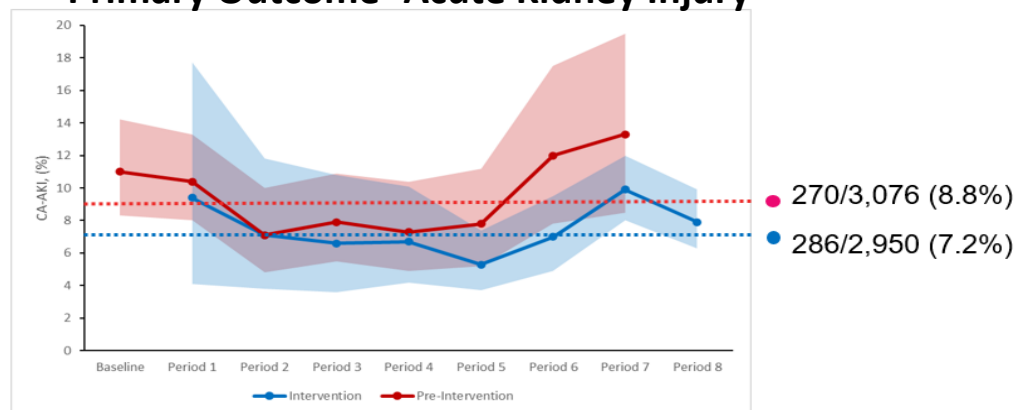
What were the primary and secondary outcomes of the project?

The primary outcome was AKI. Secondary outcomes included contrast volume and intravenous fluid use as well as major adverse cardiovascular and kidney events at one year.

What did the evaluation reveal?

Thirty-four physicians performed 7,820 procedures in 7,106 patients who met the inclusion criteria. The proportion of procedures where excessive contrast volumes were used was reduced from 51.7% to 38.1% (p=0.002), while the proportion of procedures in eligible patients where insufficient intravenous fluid was given decreased from 75.1% to 60.8% (p=0.002) with the intervention. The incidence of AKI was significantly reduced, from 8.6% without the intervention to 7.2% with the intervention (time adjusted odds ratio, 0.72; 95% confidence interval [CI], 0.56 to 0.93; p=0.01). There were no significant differences between groups in major adverse cardiovascular events.

Primary Outcome- Acute Kidney Injury



Time adjusted

OR 0.71 (95% CI 0.55, 0.92)

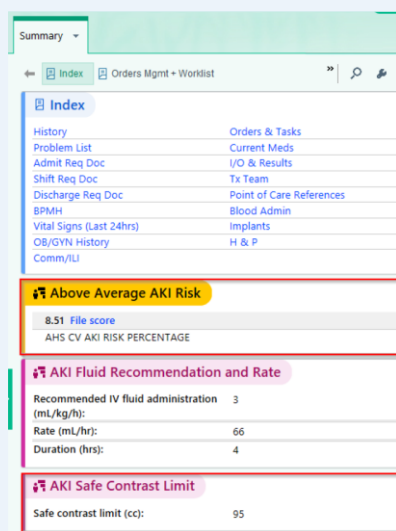
Multivariable adjusted

OR 0.66 (95% CI 0.54, 0.88)

Sustaining the initiative

Connect Care

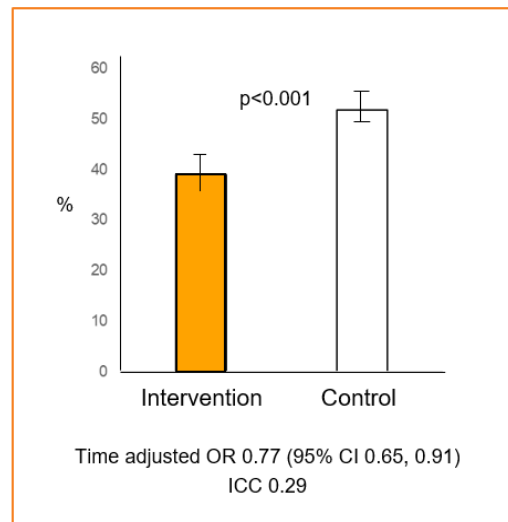
Collaboration with Connect Care has embedded the decision support tool in the new provincial Epic electronic medical record, which was launched with Wave 1 of Connect Care Implementation at the Mazankowski Heart Institute in November of 2019, and will be used to sustain the initiative at all 3 sites in the future.



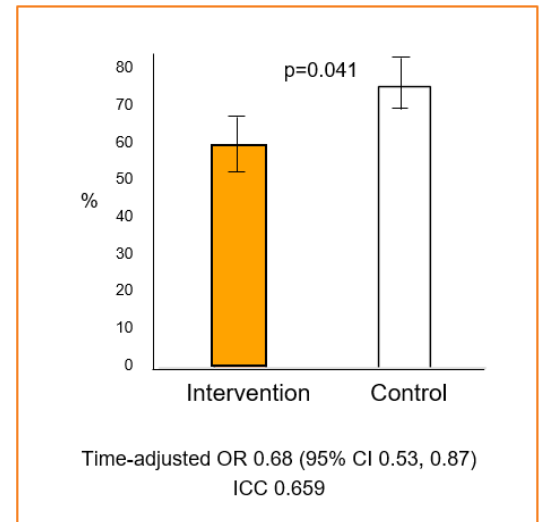
Physician Learning Program

The Physician Learning Program has been engaged to sustain the Audit and Feedback process with cardiologists at all sites.

Secondary Outcomes- Process of Care



Exceeded Safe Contrast Limit



Insufficient IV Fluid

Secondary Outcomes- Clinical Outcomes

	Intervention N=4,327	Control N=3,493	Time adjusted OR (95% CI)	ICC
Major adverse CV events, n (%)	1,238 (28.6)	1,099 (31.5)	0.96 (0.83, 1.12)	0.02
Mortality	328 (7.6)	310 (8.9)	0.91 (0.72, 1.15)	0.01
Heart failure	298 (6.9)	228 (6.5)	1.13 (0.86, 1.47)	0.05
Angina or myocardial infarction	343 (7.9)	336 (10.5)	0.96 (0.74, 1.25)	0.21
Unplanned revascularization	594 (13.7)	502 (14.4)	0.94 (0.77, 1.16)	0.06
Major adverse kidney events, n (%)	409 (9.4)	392 (11.2)	0.83 (0.67, 1.03)	0.02
Acute dialysis	33 (0.7)	36 (1.0)	0.75 (0.17, 3.37)	0.21
End-stage kidney disease	36 (0.8)	38 (1.1)	0.71 (0.15, 3.29)	0.23
Hospitalization for AKI	61 (1.4)	62 (1.8)	0.68 (0.42, 1.11)	0.21

What is the conclusion and relevance of this project?

A multifaceted intervention resulted in less contrast dye use, greater intravenous fluid administration, and reduced the incidence of AKI following invasive coronary procedures. The estimated impact in Alberta includes a Number Needed to Treat (NNT) of 44, meaning one episode of AKI is prevented for every 44 patients the intervention during a heart procedure in Alberta. Given that each episode of AKI results in an additional \$5,530 per episode of care, if 1 in 5 AKI events are avoided (Alberta estimate, 1,350 episodes/year), sustaining this project has the potential to save \$1.5 million per year in Alberta. The implementation of this intervention is feasible in any system with electronic medical records at point of care, informatics resources to audit and report on care practices and outcomes, and a culture of quality improvement to support processes to improve care.