Critical Care
Strategic Clinical Network™

Transformational Roadmap 2019–2024

Alberta Health Services
Inspiring solutions. Together.

Critical Care Strategic Clinical Network™

November 2019

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A word from our leadership team

We have the great privilege of working with a dedicated network of patients, families, healthcare professionals, policy-makers and administrators across Alberta who are passionate about our goal: to provide high-quality, evidence-based care for critically ill patients and their families through innovation and collaboration. We are fortunate to have a fertile environment for delivering high-quality intensive care throughout the province. This environment stems from a powerful culture of quality- and evidence-informed care; comprehensive data and analysis; cross-province collaboration; and team-based, patient-centred care. Our people and these assets form the foundation of the Critical Care Strategic Clinical Network™ (CC SCN).

This refreshed Transformational Roadmap (TRM) builds on our network's growth since its inception as an operational clinical network in March 2010, and its subsequent transition to the CC SCN in January 2013. We created this roadmap for the future with you, drawing on your input, ideas, passion and constructive criticism. This roadmap builds on our engagement with operational and medical leaders, and with patients and families. Informed by Alberta-based data and research, our plan leverages the Alberta Health Services (AHS) culture of quality- and evidence-based practices. We are confident that our core committee and its network can collaborate to resolve the challenges facing our critical care community over the next five years.

Thank you for contributing to the development of our new TRM. We look forward to working with all of you to improve patient outcomes, and to improve the experiences of patients, families and healthcare professionals. Through the directions and priorities we've identified together, we can make our healthcare system more effective and sustainable.

Sincerely,

Nancy Fraser
Senior Provincial Director

Dan Zuege
Senior Medical Director

Sean Bagshaw
Scientific Director

Advisor's perspective

In keeping with our principle of patient- and family-centred care, the CC SCN and critical care community will continue to engage with patients and families, involving them in setting network priorities, and co-designing projects and grant applications. Our patient and family advisors will also continue to play important roles on committees and project working groups. Throughout our TRM, you will see the perspectives of patient and family advisors who volunteer their time, experience and passion to help improve critical care in Alberta.

One such advisor is D'Arcy Duquette, who brings the patient perspective to the CC SCN Core Committee. He has received treatment for colon and lung cancer in Alberta's health system, and his story includes both negative and positive experiences. Having spent several days recovering in ICU, D'Arcy brings a unique perspective to our team: he knows what it feels like to be a vulnerable patient, trusting his care to multiple healthcare professionals.

In addition to his CC SCN work, D'Arcy participates on several teams that ensure ICU patients receive safe, high-quality care. D'Arcy's roles include:

- Chair, Patient and Family Advisory Committee (PFAC) with the Health Quality Council of Alberta
- Member, Citizen Advisory Team with the South Health Campus
- Member, Canadian Patient Safety Institute Surgical Safety Action Team
- Patient Advisor, Choosing Wisely Alberta
- Member, Accelerating Primary Care Conference Committee.

D’Arcy explains how he approaches his advocacy role, and why the patient voice is so vital to the CC SCN:

“A question I ask myself anytime I am involved on any panel or committee in healthcare is: What would the patient want? Working with the CC SCN allows a patient perspective to be included during discussions and concept development. Being involved also gives me the opportunity to help medical staff understand procedures from the patient’s point of view. If we can make discussions on treatment more of a two-way conversation, that can be beneficial to both patients and medical staff. As we work through the system creating positive change, I know that we can provide safe high-quality care for all Albertans.”

D’Arcy Duquette, patient advisor

TRM at a glance

The chart below gives a high-level look at our roadmap, showing how our priorities align with our mission, principles and strategic directions. The roadmap that follows will give more detail on how we will execute this plan.

Transformational Roadmap 2019-2024

CRITICAL CARE STRATEGIC CLINICAL NETWORK™ TRM

Mission: ***The Critical Care Strategic Clinical Network™, through innovation and collaboration, works to ensure evidence-based, quality care for people in Alberta experiencing critical illness or injury.***

PRINCIPLES: Patient- and family-centred care, evidence-informed decision-making and quality improvement

STRATEGIC DIRECTIONS	1 System transformation	2 Clinical best practices	3 Maturing as a learning healthcare system	4 Building our identity
PRIORITIES	• Sustaining Delirium Initiative • Transitions in Care	• Optimal utilization of blood products • Optimal ventilation strategies for patients with hypoxemic respiratory failure • Conservative versus liberal use of oxygen • Optimal use of continuous renal replacement therapy	• Increase knowledge, expertise and practical experience as learning healthcare system • Optimize our existing critical care data assets and clinical analytics reporting tools • Analytics demonstration projects • CC SCN projects and partnered research grants incorporate learning healthcare system goals and objectives	• Champion the value of critical care in Alberta • Increase understanding of the network's benefit and impact

Our achievements

Since the launch of the Critical Care Strategic Clinical Network™, the core committee, in partnership with the critical care community, has defined work priorities and responded to the needs of critically ill people in Alberta and their families.

The CC SCN, leaders in AHS Critical Care Operations, and health services researchers in our broader critical care community and patients and families have worked together to fulfill the goals identified in our previous transformational roadmaps. These goals focused on treatment of delirium, fostering public engagement, and creating new staff training programs and key performance indicators.

Reducing the incidence and impact of delirium in ICU patients

The Provincial ICU Delirium Initiative has established and implemented a standardized, provincial approach to improving care for all ICU patients, resulting in significant changes in clinical practice and improved patient outcomes. Achievements include:

- Establishing a provincial collaborative community for adult and pediatric critical care
- Implementing standards supporting best clinical practices for ICU delirium prevention, management and care. Ninety per cent of all adult patients are screened for delirium every day using a validated tool.
- Co-designing patient- and family-centred resources focused on delirium in ICU settings
- Improving patient and system outcomes by:
    - Reducing by 10 per cent the number of days patients experience delirium
    - Preventing 659 episodes of delirium
    - Avoiding $9,684 in health system costs per episode of delirium that was prevented.
- Receiving the **President's Excellence Award–2019** for Outstanding Achievement in Quality Improvement.

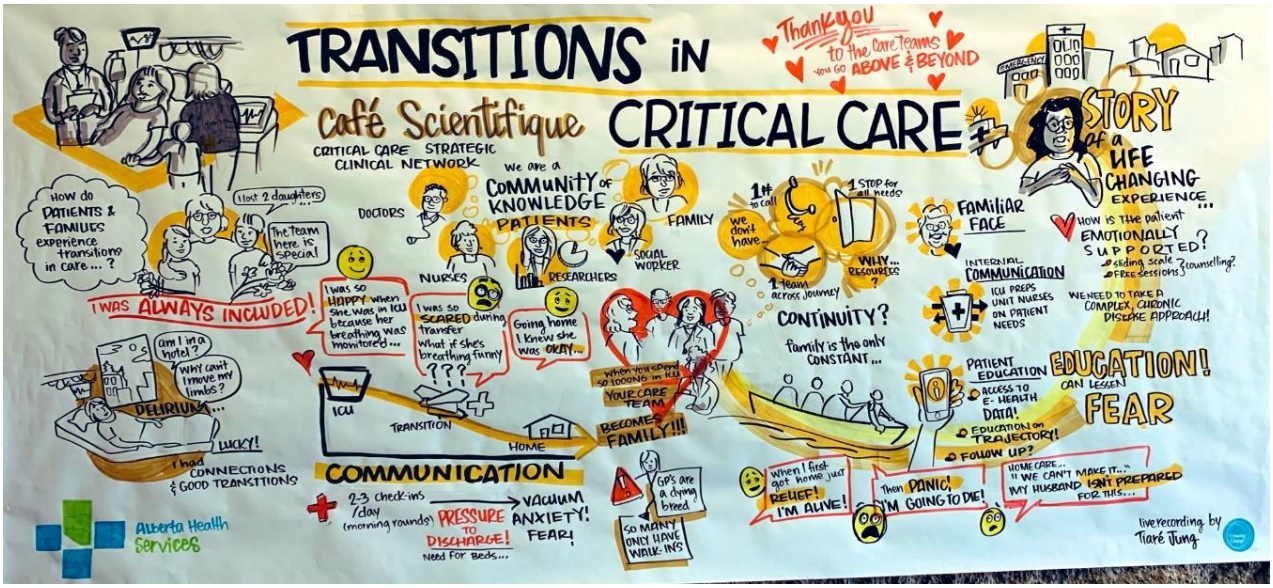
Now that there is a standardized approach to the documentation, prevention and management of delirium in ICU settings, the CC SCN aims to further support ICUs across the province to sustain and improve on the clinical innovations gained.

Orientation Program for Adult Critical Care in Alberta partnership

The CC SCN, in partnership with Critical Care Operations and Health Professions Strategy and Practice, facilitated the development and implementation of an innovative five-week provincial orientation program, reflecting provincially standardized clinical content and practice. With the aim to quickly and safely transition all new nurses to the ICU environment, the program has enrolled 209 learners (169 adult, 40 pediatric) in 2018–2019 and 2220 learners (1951 adult, 269 pediatric) since its inception in 2011.

Fostering public engagement through Café Scientifique

The CC SCN has hosted three public Café Scientifique events to facilitate the sharing of experiences between patients and healthcare professionals, and to inform the public about CC SCN priorities. The most recent CC SCN Café focused on challenges with transitions in care from the ICU to alternate care settings. The following infographic is a visual representation of this event.



Development and application of key performance indicators

The CC SCN has established a standardized provincial suite of key performance indicators (KPIs) that align with best practice recommendations and reflect the priorities of Alberta's critical care community. These ICU-specific and provincial-level KPIs are based on routinely documented electronic health record data in eCritical MetaVision (now evolving to Connect Care), and are supported by the eCritical TRACER clinical analytics system.

KPI data are updated in real time and are readily available through eCritical Alberta (see the summary of adult and pediatric data for 2018-19 fiscal year, shown in **Appendix 1**).

KPIs allow us to measure our progress against goals identified in the Transformational Roadmap.

Supporting Connect Care

For more information on Connect Care go to:
https://www.albertahealthservices.ca/info/cis.aspx

Over the past three years, the CC SCN has also helped AHS build and implement Connect Care, a digital system that helps patients and practitioners access healthcare information, define best practices and inform health planning. In collaboration with the Connect Care Critical Care Area Council (CCCCAC) and the critical care clinical operations teams, the CC SCN facilitated provincial input and helped build a consensus on recommendations for elements of the Connect Care build and its use. Our network advised on several aspects of the Connect Care build, including: optimizing clinical documentation; ordering set content; and leveraging best practices for preventing, identifying and managing delirium in ICU patients. Our network also facilitated the confirmation of provincial critical care acuity scoring tools for adult ICUs, and we advised on clinical documentation and clinical decision support related to falls prevention in ICU patients.

Enabling innovative critical care research and knowledge translation

A key accomplishment over the past three years was the securing of valuable funding, sharing useful evidence and publishing important results.

Collaborative research grants (selected examples)

- ICU Capacity Strain
- Evidence-Care Gaps
- Reducing the Use of Blood Products
- Evaluating Family Identification of Delirium in ICU Patients
- Transitions In Care
- Stress Ulcer Prophylaxis
- Timing of Dialysis in ICU Patients

Conference presentations (selected examples)

- Choosing Wisely (Mar 2019) Measurement, Evaluation and Implementation Science of the Provincial ICU Delirium Initiative
- World Congress of Intensive Care Medicine and Critical Care Canada Forum (Oct.–Nov. 2019) Gastrointestinal Bleeding Algorithm
- Critical Care Canada Forum (Nov. 2019) ICU Delirium Collaborative, 1) Audit and Feedback, 2) Implementation Science, Jeanna Morrissey – CCF Outstanding Health Professional Abstract Award

Publications

- Best practice implementation (5 publications)
- Transitions in care and quality improvement (6)
- Stress ulcer prophylaxis (2)
- ICU organization and operations management (4)
- Patient/family/stakeholder engagement (1)
- Critical care nephrology (5)
- Critical care epidemiology (3)
- Frailty and vulnerable populations (4)
- Others (sepsis, cardio-respiratory, delirium) (6)

For a more detailed description of the work highlighted in this section, see **Appendix 2.**

Introduction

This Transformational Roadmap (TRM) serves as the strategic plan for the Critical Care Strategic Clinical Network (CC SCN) over the next five years. Our plan builds on the successes of the CC SCN since its launch in 2013. The strategies and priorities outlined in this TRM build on our work during the three years since the publication of our last roadmap. We've also incorporated new priorities. The goal is to improve patient outcomes, patient and family experiences, healthcare professional satisfaction, and the value and sustainability of critical care in Alberta's healthcare system. Our TRM is aligned with *Alberta's Strategic Clinical Networks Roadmap 2019–2024* and the *Alberta Health Services Health and Business Plan.*

The Critical Care Strategic Clinical Network™, in collaboration with our provincial critical care community, uses innovative approaches to identify and address practical problems facing our patients, creating evidence and translating it into day-to-day practices.

Over the next five years the CC SCN and its associated critical care communities, along with many partners and stakeholders, will work to improve the quality of care and outcomes for critically ill patients and their families in Alberta.

Critical care in Alberta

Critical care comprises specialized care for patients who have complex, life-threatening medical problems requiring urgent and intensive treatment involving life-support technologies and inter-professional collaborative approaches.

Critical care professionals generally treat patients in an intensive care unit (ICU). However, services have increasingly extended outside the ICU, due to the growing implementation of rapid response systems. Critical care services play a vital role in acute care in Canada; however, they are resource intensive and costly to maintain. In 2013–2014, 11 per cent of the more than two million adult hospital stays in Canada (outside of Quebec) included time in an ICU.[1] The demand for critical care beds and services is anticipated to grow over time, driven by population growth and aging, increasing patient complexity and severity of illness, advances in medical care and technology, and the high expectations of patients and families for effective healthcare.[2-4] All of these factors are likely to contribute to an expected increase in the demand for critical care and, in turn, an associated cost increase in the coming decades.[5]

In Alberta, critical care is provided in twenty intensive care units, which operate a total of 295 funded beds across all five health zones. Our ICUs include:

- Fourteen adult mixed general medical/surgical ICUs
- Two adult cardiovascular surgical ICUs
- One adult neurosurgical ICU
- Two pediatric ICUs
- One pediatric cardiac ICU.

Care in Alberta ICUs is provided by approximately 2,000 healthcare professionals, including nurses, physicians, respiratory therapists, pharmacists, physiotherapists, occupational therapists, dieticians and social workers. In the 2018–19 fiscal year, these teams cared for over 15,500 patients (2,200 pediatric and 13,300 adult), accounting for

96,000 days in ICU (13,000 pediatric and 83,000 adult). The following statistics describe critical care patients and services in Alberta in 2018–19:

- The mean age of adult ICU patients was 58 years. The mean age of pediatric ICU patients was 5 years (median 2.4).
- Among ICU admissions, 66% of adult patients and 43% of pediatric patients received invasive mechanical ventilation; 55% and 29% of adult and pediatric ICU admissions, respectively, required support with vasopressor medications; 7.5% and 1.5 % of adult and pediatric ICU admissions, respectively, required support with renal replacement therapies.
- Thanks to advances in treatment and quality of care, 89% of critically ill/injured adults and 97.5% of pediatric patients survived their ICU stay.
- Patients were at times ready to move to a less intense level of care; however, they were unable to do so because ward beds were not available. This occurred for 10.5% and 7.4% of the total ICU patient days for adults and children respectively.
- The total operational costs for critical care in Alberta were approximately $300 million during the 2018–2019 period.

The Critical Care Strategic Clinical Network

Our Mission
The Critical Care Strategic Clinical Network™, through innovation and collaboration, works to ensure evidence-based, quality care for people in Alberta experiencing critical illness or injury

The Critical Care Strategic Clinical Network (CC SCN) is comprised of a small group of dedicated individuals, consisting of frontline healthcare professionals, operational and medical leaders, patients and families, researchers, eCritical Alberta staff, policy-makers and a number of other stakeholder groups. This team works in collaboration with the critical care community in Alberta to achieve its goals.

The CC SCN helps Alberta's health system develop and implement evidence-informed, healthcare professional-led, team-delivered critical care services and health improvement strategies that lead to better outcomes for patients and families, and greater value for the health system. Frontline staff are crucial to this work, participating in expert working groups and project teams, and making vital contributions to the development, implementation, and evaluation of priority initiatives.

The CC SCN with our community will continue to add value and sustainability in our health system by:

- Increasing efficiencies to add capacity and reduce costs
- Minimizing avoidable delays in ICU discharge in favor of more clinically appropriate lower-intensity levels of care when patients are ready.
- Decreasing avoidable ICU readmissions and longer-term complications of critical illness/injury
- Improving patient and family experience and satisfaction, particularly related to continuity in care. Improving healthcare professional satisfaction by easing pressure points like stress and burnout.

Crucial to creating the greatest positive impact on the health system and patient care is ensuring a consensus among the critical care community on how to proceed with our work. This plan will help our whole community contribute in a focused and meaningful way to improvements in care for critically ill patients in Alberta.

Principles

Three principles underpin the CC SCN's work. Focusing and strengthening these principles builds a strong foundation for the CC SCN to continue to improve care for critically ill patients across the province. These principles are:

- Patient- and family-centred care
- Evidence-informed decision-making
- Quality improvement.

Patient- and family-centred care

Patient- and family-centred care is central to all CC SCN work. It is an approach to the prioritizing, planning, co-design, delivery, and evaluation of our strategies and initiatives, that is grounded in mutually beneficial partnerships between healthcare professionals, patients and families. It involves working with patients and families to improve their healthcare experience, and to improve the quality, safety and efficiency of critical care services. This collaboration is being achieved through engagement with our core committee, existing and future working groups, patient and family advisory boards, design planning teams, staff educational programs, quality improvement projects, and evaluation and research activities, all of which aim to directly include the patient and family voice.

Evidence-informed decision-making

The principle of making evidence-informed decisions ties with our goal of maturing as a learning healthcare system (LHS). In an LHS, internal data and experience are systematically integrated with external evidence, and that knowledge is put into practice (About Learning Health Systems. Content last reviewed May 2019. Agency for Healthcare Research and Quality, Rockville,

MD https://www.ahrq.gov/learning-health-systems/about.html).

We also encourage critical care healthcare professionals to appreciate the value of data and analytics in decision-making and care delivery: eCritical Alberta currently delivers a comprehensive, multimodal, and integrated data repository of patient-specific information, presenting real-time information for optimal and timely patient-specific decision-making. This information system enables the creation of timely unit, zone and provincial reports for administrative, quality-improvement, education, and research purposes. Its two main components, MetaVision (a bedside clinical information system) and TRACER (a data warehouse and clinical analytics system), help critical care staff and physicians, operational leaders, and stakeholders make evidence-informed decisions for patient care, administration and health system planning. Connect Care will extend our data assets and clinical analytics reach even further.

Quality improvement

The principle of quality improvement (QI) informs myriad aspects of our work. QI is a continuous and iterative process of identifying issues and opportunities, applying evidence-informed solutions, and learning from the process and resulting outcomes. The CC SCN uses quality improvement with stakeholder engagement to:

- Identify and prioritize potential health system innovations and improvements
- Develop and apply quality improvement tools and techniques
- Encourage the adoption of leading practices across the province.

The CC SCN supports a learning culture by embedding continuous quality improvement and implementation science into its work, and by enriching the critical care community's existing QI culture.

Development of the 2019–2024 Transformational Roadmap

Below is an overview of the process undertaken to refresh the Critical Care Strategic Clinical Network Transformational Roadmap.

Strategic Directions

Strategic direction 1: System transformation

System transformation encompasses profound changes that orients healthcare in an entirely new direction and level of effectiveness. The CC SCN will focus on two priorities to help drive system transformation: 1) establishing the ICU Transitions in Care program, and 2) sustaining the initial successes of the existing Delirium Initiative. These projects aim to create positive impact within the ICUs and within care areas—both upstream and downstream from critical care.

Although the primary transformation focus will be on Transitions in Care as a signature project, the CC SCN will continue to monitor and respond to system needs as they are identified.

Transitions in Care project

Transitions in Care is a high-level priority for the CC SCN as we help transform Alberta's healthcare system. Managing how patients move between healthcare professionals, programs, locations, and levels or sectors of care (at the same or different locations) is also a significant priority for Alberta Health Services (AHS),[6] for the Strategic Clinical Network portfolio,[7] for Accreditation Canada,[8,9] and for all people of Alberta.[10] Healthcare professionals, leaders, and patients and families identify transitions in care in critical care as a top priority for targeted improvement in Alberta.[10] Collaborating with the critical care community and other SCNs, the CC SCN will lead the transformation of the health system by ensuring care is integrated and coordinated during the ICU patient's journey.

The CC SCN and its clinical and research partners will develop and implement an innovative provincial Transitions in Care bundle, addressing transitions across the critically ill patient's journey. Emerging evidence suggests that transition strategies and interventions may be more effective when implemented in multi-component bundles.[11,12] Key components include discharge planning, medication safety, dedicated transitional care personnel, coordination among team members, patient empowerment for self-management, and follow-up care.[13] This work will result in improved outcomes and experiences for patients, families and providers, along with increased value for the health system.

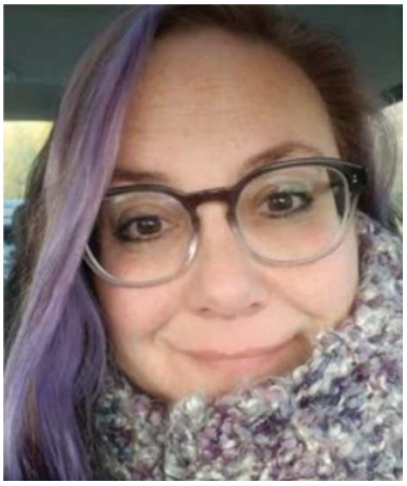
The Transitions in Care project will be phased over five years to incorporate transitions into, within, and out of the ICU care setting. Phase 1 will focus on transitions out of the ICU.

Transitions in Care: Why is this important?

Transitioning patients between different levels of care involves changes in accountabilities for the patient and family, and often involves changes in care needs. A transition during the patient journey is generally accepted as a time of particular risk, even more so for patients recovering from critical illness, given their burden of disease and care complexity.[14] Transitions in care involve multiple health care professionals, processes and practices, all aligned to ensure coordination, continuity, and communication. Care transitions can have a profound influence on patient and family outcomes and experiences.

Patients transitioning into and out of ICUs are the sickest and most vulnerable in our healthcare system. Discharging critically ill patients from the ICU is one of the most challenging, high risk, and inefficient transitions in healthcare. These patients have complex, prolonged treatments and recoveries, and their care involves multiple providers, processes, and practices. Coordination and communication must be streamlined to ensure continuity of relationships, management of care, and information.

Prior studies of care transitions from ICU to a lower-intensity level of care have identified several potentially modifiable gaps related to patient and family communication and healthcare-professional communication. Studies have also identified redundancies in testing and treatments, and in the prevention of adverse events.[12,14,15]



"Being a family advisor fits with how I was raised—I come from a family where contributing to one's community was just what you did. As a member of the Transitions in Care Working Group and the Critical Care SCN Core Committee, I am excited to be able to share my experiences and perspectives in ways that make an impact. Our family has experienced many transitions in and out of ICU and other parts of the healthcare system, so I jumped at the opportunity to join this group and share how transitions could be improved from a parent or family member perspective. As a member of the core committee, I am able to share my personal skill set of seeing the big picture by contributing to strategic planning and system transformation."

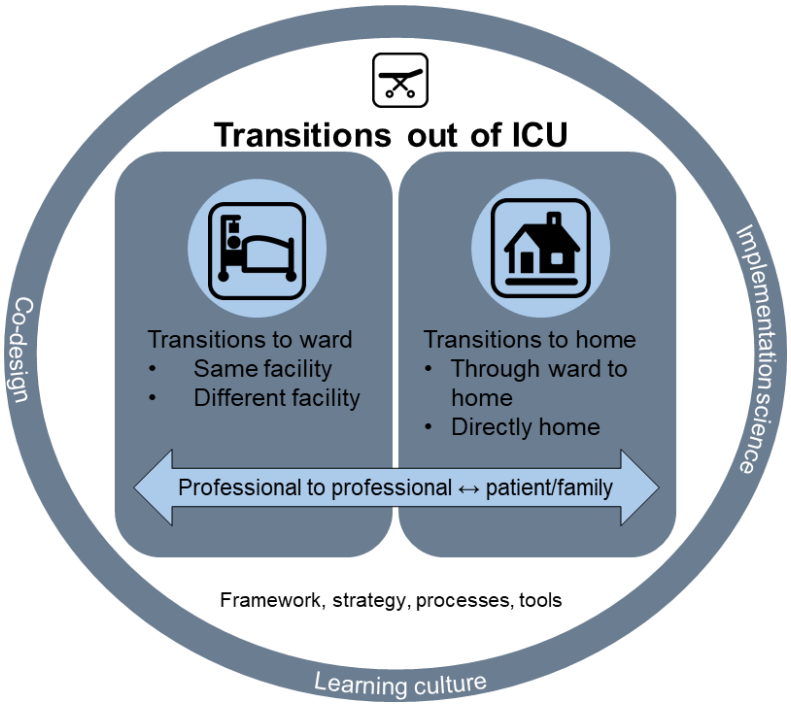
Simone Chalifoux, family advisor, CC SCN

Transitions in Care: Future plans

This multi-year phased project takes a "whole care team" collaborative approach to address transitions across the continuum of care for critically ill patients and their families. We will design the project as a learning process, offering team members opportunities in co-design, novel research and improvement, and implementation science.

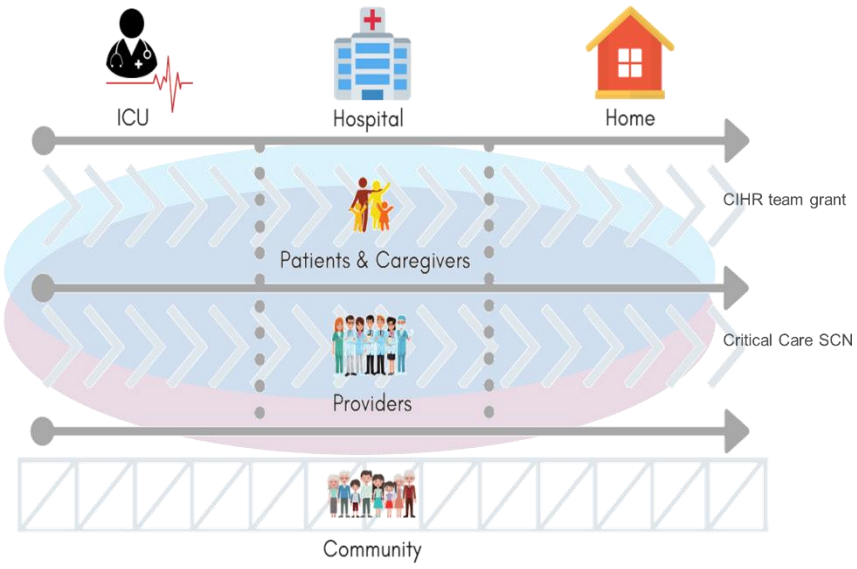
The phases of work begin with gathering data and information about the current state. Three subsequent phases will cover the main transitions along the patient journey—into, within, and out of the ICU—from the perspectives of the patients and families, and of healthcare professionals who care for adult and pediatric patient populations in all

critical care units in Alberta. The image below depicts the processes involved in phase 1.



This project is a collaboration between academic researchers, the CC SCN and clinical operational teams. The process includes integrated research and quality improvement streams, as depicted in this graphic.

The CIHR Team Grant (research) stream is being led by Dr. Kirsten Fiest and the Department of Critical Care Medicine at the University of Calgary. This collaboration is reflected in a joint governance structure, which includes an executive committee, a steering committee and four working groups reporting up to the CC SCN Core Committee. This structure allows for accountability, collaboration, staged involvement, and financial investment input from the various partners.



Transitions in Care: Indicators of success

The following results will indicate that the Transitions in Care project has been successful in helping to transform the healthcare system:

- Development, implementation, evaluation, refinement and use of the tools and practices in ICUs across Alberta
- Enhanced patient and family experience and satisfaction through more deliberate patient- and family-centred communication, and through improved involvement and care during transitions out of ICUs
- Decreased preventable adverse medical events during and following transitions
- Decreased avoidable readmissions to ICUs
- Decreased avoidable emergency department visits following transitions from ICU to home/medical home
- Improved relationships between healthcare professionals and improved overall experience for professionals (e.g. reduced anxiety and burnout) related to transitions along the patient journey.

Delirium Initiative

Why is this important?

The Delirium Initiative has had a substantial impact on the patients and families we serve. Now that there is a provincial standardized approach to the detection and management of ICU-associated delirium, our teams recognize that sustaining and building on these improvements will require ongoing focus and attention. As a result, the SCN will continue to support ICUs across the province to ensure that Delirium Initiative practices continue to effect change.

"I have been a patient advisor with the Critical Care Strategic Clinical Network since 2015 and felt compelled to get involved because I wanted to give back after spending five weeks in intensive care. Reflecting on my years volunteering with the network, I am impressed by the commitment and skill of critical care clinicians across Alberta and am proud to have been a member of the Critical Care SCN Core Committee and a patient advisor for the provincial ICU Delirium Initiative to improve prevention and management of delirium for patients and families in ICUs across Alberta. Check out my story at https://www.youtube.com/watch?time_continue=10&v=ELaAjR44YgA.

Looking forward, I am excited to contribute to work that the CC SCN and the University of Calgary, Department of Critical Care Medicine are doing to improve transitions in care, including post-ICU care, because I have firsthand experience in how important good transitions and follow-up care are for ICU survivors. I am passionate about this because so much time and resources are spent in ICU to literally save patients' lives, and collectively we need to honor that investment by supporting patients and families in their transitions and in their aftercare at home to achieve the best possible 'new normal.'"

Nadine Foster, patient advisor, CC SCN

Delirium Initiative: Future plans

Over the next several years our teams will work on the following strategies:

- Continued operation of a Provincial Critical Care Delirium Steering Committee for ongoing oversight of measurement, audit and feedback, collaborative learning, and unit-based improvement initiatives
- Continued provision of self-access operational and quality improvement dashboards containing delirium performance information to provide feedback and facilitate continued quality improvement and knowledge building
- Continued quarterly audit and feedback reports provided to frontline healthcare professionals and unit leadership. Quarterly reports are distributed to zone and site leadership.
- Provision of up-to-date information on delirium care during nursing orientation
- Healthcare-professional education through virtual collaborative learning sessions, scorecards, access to clinical experts, and QI methods adapted to the Alberta context
- Ongoing engagement with partners in research and innovation
- Ongoing leveraging of the collaborative practice culture in Alberta ICUs through this and other CC SCN initiatives.

Delirium Initiative: Indicators of success

The following markers will indicate that the Delirium Initiative continues to have a positive impact on patients:

- A reduced proportion of patient days where patients experience delirium:
    - Patients are screened for delirium twice daily
    - The rate of unplanned extubations does not increase.

In addition, we will continue to improve best practices for delirium prevention, management and care, including:

- Assessing pain and managing significant pain
- Assessing agitation and sedation
- Assessing mobility readiness and implementing daily mobility events
- Including family members in delirium identification, prevention and management
- Decreasing unnecessary variations in care and ensuring consistent standards of care across the province.

System transformation: On the horizon

The Alberta critical care community identified a number of additional potential system transformation opportunities that will be explored further over time:

Advance care planning

There is increasing recognition that a significant number of pediatric and adult patients with critical illnesses are unlikely to benefit from advanced life support interventions in the ICU, and many of these patients may not want such interventions. A significant proportion of these patients may not understand the nature of advanced care in ICU settings and may not have been exposed to advanced care planning.

This issue clearly extends well beyond critical care into most inpatient and outpatient care areas, with several parallel advanced care planning projects underway in Alberta. There is potential opportunity for critical care teams to play more active roles in the following areas:

- Advanced care planning at the point of transition out of ICU after surviving a critical illness
- Informing broader health system education, policy and advanced care planning projects about the likely outcomes of critical illness in common disease states and severities of illness.

ICU capacity and throughput

We are finding that patients often face significant obstacles when entering and exiting ICUs, with significant variation by unit and over time. There is the potential to develop a clearer understanding of ICU throughput, and clarify the predictors of ICU strain in Alberta. From this, there is the potential to test strategies to increase throughput and reduce ICU capacity strain.

Post-ICU care

Evidence increasingly reveals the need to mitigate the significant, lasting physical and mental morbidity in ICU survivors. As a result, AHS has established post-ICU recovery clinics in the Calgary and Edmonton Zones. There is the opportunity to better

understand the needs of this patient population to tailor existing supports and test novel interventions with the goal of improving the quality of life of patients and their families as patients recover—both mentally and physically—from their time in the ICU.

Supporting our staff

Recognizing the impact of stressful ICU environments on staff health, burnout and moral distress, there is the opportunity to collaboratively develop strategies and tools to build staff resilience.

Strategic direction 2: Clinical best practice

The CC SCN has focused on a number of daily care practices over the past years, including the following:

- Appropriate application of prophylaxis to prevent acquisition of deep venous thromboses
- Appropriate use of inhaled vasodilators in patients with hypoxemic respiratory failure (with de-adoption of nitric oxide in favor of similarly efficacious, but lower cost, inhaled epoprostenol in adults)
- Several basic care processes linked with prevention of delirium, such as appropriate pain management, mobilization, and liberation processes from mechanical ventilation.

The projects related to these care processes have helped us build a provincial collaborative culture of improvement. In addition, these projects helped us improve knowledge translation methods and adapt tools to the Alberta context. Our teams have made improvements in measurement and in audit and feedback tools that leverage our information systems. We have also gained implementation and knowledge translation science expertise at CC SCN, unit, and department levels. These assets are a substantial investment which will enhance the next group of care processes designed by the CC SCN.

Though we have improved a number of care processes over the past years, we recognize that there remains substantial opportunity to modify additional processes where there is good evidence for best practice and where there is significant variation in practice across the province in relation to best practice. .

Clinical best practice: Why is this important?

Critical care requires the delivery of numerous common daily care practices, some applied routinely to most patients and others applied selectively based on disease states and clinical condition. These practices can affect patient outcomes and the chances of patients acquiring adverse events during their ICU stay and afterwards.

Given their application to many critically ill patients, sometimes many times a day, these care practices can contribute significantly to overall costs of care.

Clinical best practices: Priorities

The CC SCN, in collaboration with our critical care community and our research and quality improvement teams, will focus on several additional clinical best practice projects over the next five years. Our teams used several processes to determine our priorities for clinical best practices in critical care, including: the Evidence Care Gaps project (which incorporated input from frontline healthcare professionals, clinical leadership, and patients and families); several CC SCN core team meetings; surveys of our critical care community; and input from our patient and family advisors. Based on those processes, we determined that our next clinical best practice priorities will be:

1. Optimal use of blood products (albumin, red blood cells, platelets, fresh frozen plasma) and blood testing in critically ill and high-risk surgical patients
2. Optimal ventilation strategies for patients with hypoxemic respiratory failure
3. Optimal use of oxygen therapy in mechanically ventilated patients
4. Optimal use of continuous renal replacement therapy in patients with kidney injury and failure.

Though we will focus on the priorities above over the next five years, we recognize that the critical care field is dynamic, with new evidence constantly evolving and practice environments changing frequently under various influences. Over the time span of this TRM, we expect to revisit our priorities as evidence and practice environments change. Indeed, an important practice of a learning healthcare system is to constantly evaluate changes in the evidence base and in local and provincial outcome and performance measures, and dynamically revise care practices accordingly. This goal of responsiveness will be explored and tested via collaboration between the CC SCN and

Dr. Dan Niven's research team over the next five years (CIHR Project Grant 2019-2022; Creating a Living Knowledge Translation Agenda to Improve the Delivery of Evidence-Based Care in Adult Critical Care Medicine; $393,974). In the section below, **On the horizon**, we list a number of additional care practice improvement opportunities that our teams can consider.

Following are details on each of the four priority areas.

Optimal use of blood products

Blood products are precious resources derived from donated blood. Though there are widely recognized indications for transfusion of blood products in critically ill patients, numerous studies and Alberta critical care data suggest that many instances of blood product transfusion do not follow these indications and guidelines. Inappropriate transfusion of blood products is associated with adverse events and added healthcare costs. For example, one driver of anemia in critically ill patients is excessive blood testing. In Alberta ICUs, we recognize that the number of blood tests ordered daily varies widely between units, and that some of this variation is likely due to unnecessary testing.

Optimal ventilation strategies for patients with hypoxemic respiratory failure

Patients with hypoxemic respiratory failure and its most severe form, the Acute Respiratory Distress Syndrome (ARDS), face significant morbidities, including the following: prolonged exposure to invasive mechanical ventilation; sedative medications and relative immobility leading to delirium,; weakness; prolonged ICU and hospital stays; and a need for rehabilitation efforts, which often result in incomplete physical and mental recovery. In addition, ARDS can be fatal. There is now solid clinical evidence that optimal strategies for mechanical ventilation for this patient group improve outcomes; however, Alberta critical care data suggests that these strategies are used inconsistently.

Optimal use of oxygen

All patients who receive mechanical ventilation in the ICU also receive supplemental oxygen therapy. Healthcare professionals in ICU settings are generally most concerned about a life-threatening lack of oxygen; however, this concern may often translate into patients being exposed, perhaps unnecessarily and unintentionally, to excess levels of supplemental oxygen (hyperoxia). Recent evidence has suggested there may be harm associated with excess and prolonged exposure to hyperoxia. Preliminary data from Alberta ICUs suggests that many practitioners are liberal in their use of oxygen for mechanically ventilated, critically ill patients. This situation provides a unique opportunity to understand the current use of oxygen in mechanically ventilated patients, and to design, develop, implement, and evaluate strategies for more appropriate and conservative approaches to oxygen therapy in ICU settings.

Optimal use of continuous renal replacement therapy

Continuous renal replacement therapy (CRRT) is a form of dialysis used to treat acute kidney injury, a common complication in critically ill patients that is associated with substantial morbidity and risk of death. Approximately 5% of adult ICU patients received CRRT during their ICU stay in 2018–19, and these patients had a mortality rate of 44%, compared to 10.6% for all adult ICU patients. Rates of CRRT use are variable across those ICUs capable of providing this advanced organ support. CRRT is less commonly used for children (1.4%) but has a similar, significant associated mortality rate (40%). There is increasing recognition that patient outcomes, as well as care costs, may depend on how effectively CRRT is delivered. In Alberta, CRRT is currently delivered via a number of different modalities and anticoagulation regimes. This variation provides a unique opportunity to evaluate whether gaps in current care exist, and to design and implement improved processes for CRRT.

Clinical best practice: Future plans

From the four main priorities outlined above, our teams will tackle several related projects over the next few years.

Optimal use of blood products

Several existing grants support the current work to optimize use of albumin in adult and pediatric ICU patients (CIHR 2019-2020 $98,312 PI Dr. Dan Niven). Following a successful pilot study of albumin use in the Edmonton Zone, where albumin use decreased to more appropriate rates (30 per cent decrease from baseline), a stepped-wedge implementation trial of a multimodal intervention to optimize albumin use is currently underway, involving all adult and pediatric ICUs in Alberta. This trial is being undertaken as a collaboration between the CC SCN and research teams, and is planned to be complete by Dec. 2020.

Recent work on evaluating red blood cell transfusions in critically ill adult patients in Alberta indicated over half of transfusions do not align with best-practice guidelines for transfusion trigger points. While not specifically adjudicated, these data would imply there is likely opportunity for improved practice and resource use with respect to red blood cell transfusion.[16] A recently awarded Choosing Wisely Alberta grant (PI Dan Niven) will support initial work to plan an intervention to optimize red cell transfusions in Alberta ICU patients. A PRIHS grant (Don't Misuse My Blood) has been submitted to more fully support a program of work to optimize red cell, platelet and fresh-frozen plasma use, and the appropriate use of blood testing in the critically ill. This collaborative CC SCN/research team program of work envisions a detailed analysis of current use patterns for both blood products and blood testing, identification of barriers and facilitators to change, evolution and pilot-testing of multi-modal interventions to optimize use of these procedures, and ultimately, implementation of a piloted intervention in Alberta ICUs.

Optimal ventilation strategies for patients with hypoxemic respiratory failure

Existing grants (MSI Foundation 2018–2020 $89,000) have supported the work of Dr. Ken Parhar's research team in analyzing current mechanical ventilation practices for patients with hypoxemic respiratory failure and ARDS in Alberta, and developing and pilot-testing a pathway for optimal support of this patient population in one adult ICU. Dr. Parhar's team has identified barriers and facilitators for implementation of this pathway. They have also submitted a CIHR grant and are preparing a Heath Innovation

Implementation Spread (HIIS) grant submission (Venting Wisely) to more fully support a program of work. This collaborative CC SCN/research team program of work involves implementing the Venting Wisely pathway via a stepped-wedge implementation trial, using multi-modal interventions to optimize the use of these procedures in all Alberta ICUs.

Conservative versus liberal use of oxygen

The investigation into the use of oxygen in Alberta ICUS is being funded by an Alberta Strategy for Patient Orientated Research (AbSPOR) Pragmatic Clinical Trials grant (PI Sean Bagshaw). A CIHR grant (PI Sean Bagshaw) has been submitted to support a province-wide stepped-wedge implementation trial called the OXYICU trial. The OXYICU trial proposes a multi-modal intervention to adopt a more conservative approach to oxygen therapy than the current liberal approach used in most Alberta ICUs for mechanically ventilated patients.

Optimal use of continuous renal replacement therapy

The CC SCN and critical care community will collaborate with Dr. Oleksa Rewa, who is heading Alberta's main research project on CRRT, to evaluate our current use of this treatment. On the horizon, we envision exploring the quality of CRRT prescription and delivery, including both initiation and discontinuation, with reference to current clinical practice guidelines and accepted best practices. We will then identify opportunities for improvement and strategies for optimization.

Clinical best practice: Indicators of success

By improving the above clinical best practices as applied to critically ill patients in Alberta, we hope to:

- Reduce the number of inappropriate (guideline-incongruent) transfusions of albumin, red blood cells, platelets and fresh-frozen plasma
- Reduce the number of blood tests ordered
- Reduce the variation between ICUs in blood-test ordering practices
- Increase the proportion of patients with hypoxemic respiratory failure receiving optimal strategies for mechanical ventilation
- Reduce exposure to hyperoxia in mechanically ventilated patients
- Increase the proportion of patients receiving CRRT under optimal conditions
- Continue to foster a culture of collaborative provincial quality improvement
- Continue to evolve and test effective knowledge translation and implementation strategies, optimized to the Alberta critical care context
- Continue to evolve effective measurement, audit and feedback tools, leveraging the analytics tools and systems in eCritical and, increasingly, in Connect Care
- Collaboratively evolve knowledge translation science through academic partnership, successfully achieving grant support and implementing change through rigorous and measurable methodologies
- Continue to evolve CC SCN, departmental, and unit-level expertise and experience with quality improvement, knowledge translation and implementation science.

Clinical best practice: On the horizon

In the process of creating this TRM, the critical care community identified a number of additional care-practice improvement opportunities to consider in the future:

- Appropriate use of common diagnostic imaging tests (e.g. chest x-rays and CT scans of head and body)
- Identification and management of critically ill patients with sepsis (appropriate testing, identification of risk for antimicrobial resistance, appropriate antimicrobial use and duration)
- Frequency and content of patient/family communication around treatments and procedures
- Strategies to help patients sleep as long and as soundly as possible
- Improvement of oral hygiene practices for patients
- Identification of gastrointestinal bleeding events and associated risk factors in ICU patients
- Application of evolving evidence for optimal prophylaxis against gastrointestinal bleeding
- Prevention and management of pressure ulcers

- Temperature management in post-cardiac arrest patients.

Strategic direction 3: Maturing as a learning healthcare system

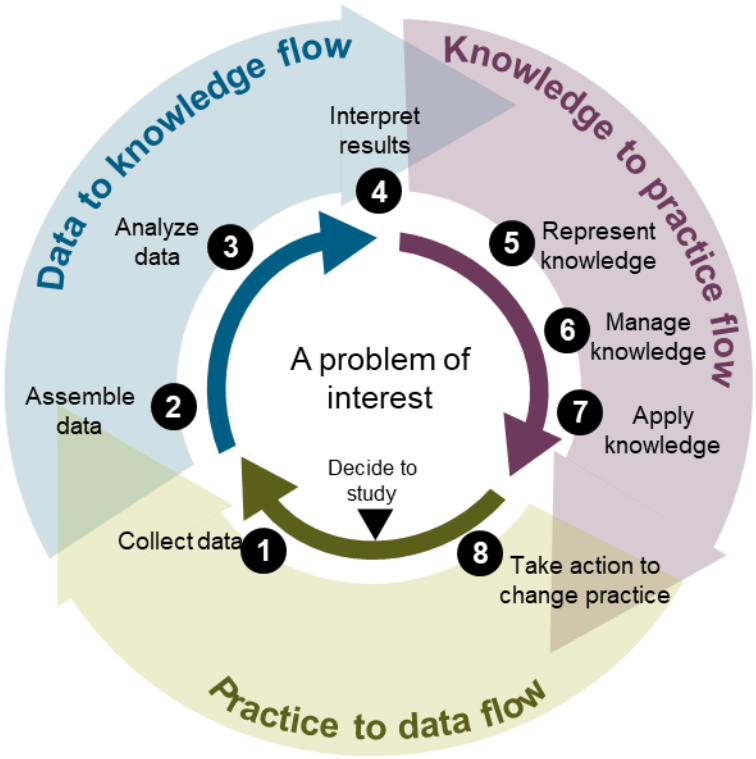
Learning healthcare systems are systems in which internal data and experience are systematically integrated with external evidence, and that knowledge is put into practice (About Learning Health Systems. Content last reviewed May 2019. Agency for Healthcare Research and Quality, Rockville, MD https://www.ahrq.gov/learning-health-systems/about.html).

Learning healthcare systems:

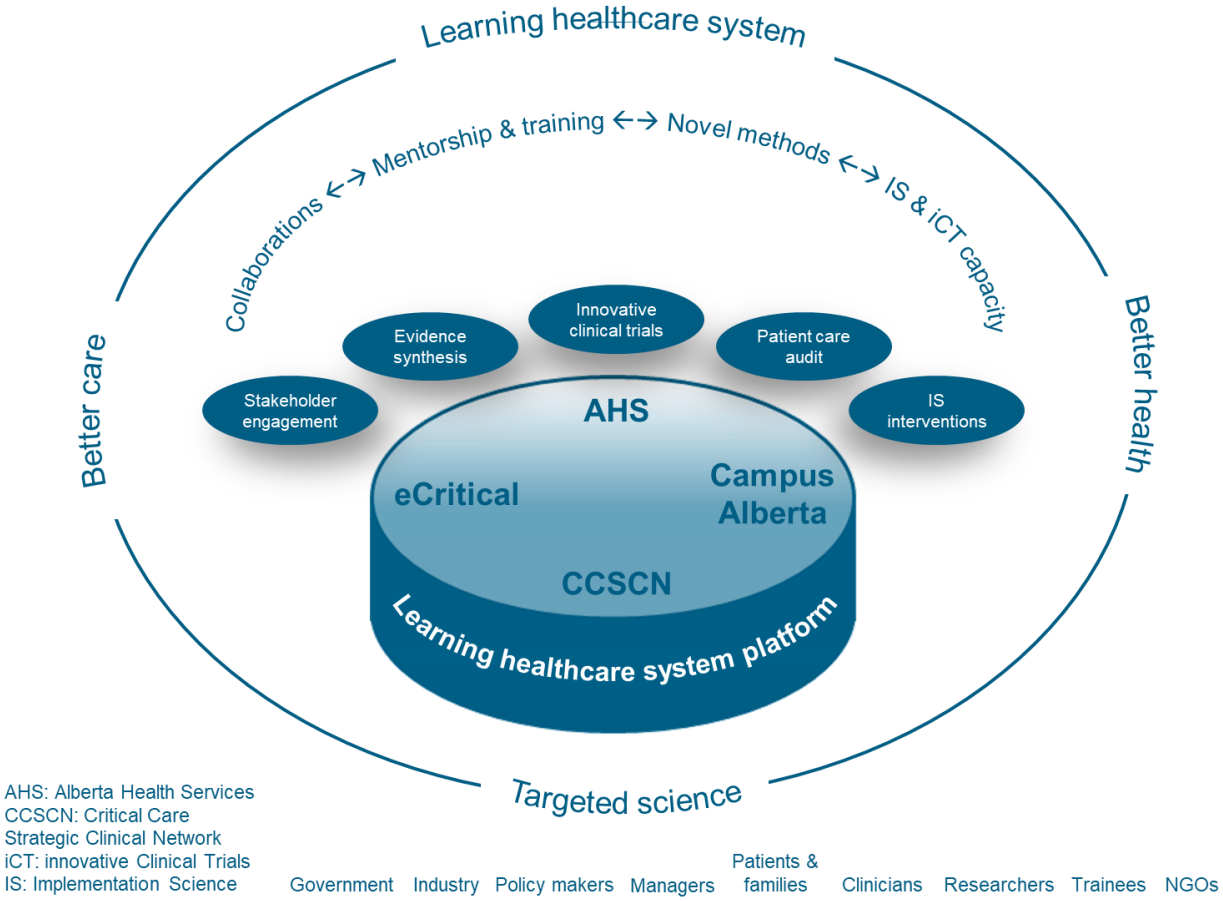
- Have leaders who are committed to a culture of continuous learning and improvement
- Systematically gather and apply evidence in real time to guide care
- Employ IT methods to rapidly share new evidence with healthcare professionals to improve decision-making
- Recommend the inclusion of patients as vital members of the learning team
- Systematically capture and analyze data and care experiences in near real time to improve care
- Continually assess outcomes to refine care processes and training, creating a feedback cycle of learning and improvement.

An evidence-informed learning healthcare system is inclusive and engages all members of the network. The goal is to engage stakeholders as agents of change. To that end, we need to work collaboratively with patients, caregivers, healthcare professionals, decision-makers and researchers, translating internally generated knowledge and scientific advances into improved care and better patient outcomes.

The Alberta critical care community has enabled many of the key structures needed to support the continued evolution of a learning healthcare system, as seen in the image below.



Adapted from: Flynn, Allen & Friedman, Charles & Boisvert, Peter & Landis-Lewis, Zachary & Lagoze, Carl. (2018). The Knowledge Object Reference Ontology (KORO): A formalism to support management and sharing of computable biomedical knowledge for learning health systems. Learning Health Systems. 2. 10.1002/lrh2.10054.



Maturing as a learning healthcare system: Why is this important?

Alberta's Strategic Clinical Networks were built on the principle of evolving a learning healthcare system within AHS. This evolution involves embedding clinical research and innovation into daily practice so that evidence-based decisions can lead, guide, and inform our journey. Learning healthcare systems deliver high-quality care that is continually informed by the best internal and external information. They rapidly and effectively implement positive change across an organization, improving patient outcomes and experiences, and adding value.

Maturing as a learning healthcare system: Accomplishments to date

In our journey to mature as a learning healthcare system, as a CC SCN within AHS, we have accomplished the following:

- We have evolved a provincial culture of sharing and collaboration, learning from each other and seeking data to inform decisions and drive improvement.
- Together with AHS Information Technology and the critical care community, we have developed and fully implemented the first province-wide critical care clinical information system in Canada (eCritical Alberta). This system provides us with rich data assets and clinical analytics tools that help us measure and query ourselves on performance and practice, in feasible and sustainable ways.
- We have assisted in setting up Connect Care to further extend our electronic—and hence queryable—data assets and measurement capabilities beyond what we already have.
- We have evolved provincial strategies to harmonize clinical best practice through programs such as the Orientation Program for Adult Critical Care in Alberta (OPACCA) nursing orientation program, and by establishing provincial standards of care for select care processes.
- We have begun educating ourselves about the characteristics of high-performing
- learning healthcare systems.

Maturing as a learning healthcare system: Opportunities

Though we have accomplished much in our journey, we have many opportunities to mature as a learning healthcare system. We understand the basic principles of learning healthcare systems, but our goal is to gain a more in-depth knowledge of this approach. In the next five years, we will pursue the following opportunities:

- We aim to learn more about how our system can better leverage data, analytics, inquiry, value assessments, and culture to maximize the breadth, magnitude, and sustainability of improvement, following the lead of several landmark health systems.
- We will build awareness in the critical care community about the full extent of existing resources and how to access, review and use available data. Though we are currently rich in data assets and clinical analytics reporting, we have likely only scratched the surface of our analytics capability to understand ourselves. Many in our community do not fully understand the range of resources available to us.
- We have likely not yet discovered or implemented the most effective ways to continually assess the ever-changing evidence base for critical care practice. We will further evaluate unit- and patient-based variation in care across Alberta, to understand the sources of variation and reduce unwanted variation. We aim to incorporate new information, along with our own experience and province-wide learnings, into revised practices in a timely manner.
- We aim to formally test learning healthcare system methods in Alberta, so we can answer focused care questions using our provincial repository of patient data.

Maturing as a learning healthcare system: Future plans

1. To continue to mature as a learning healthcare system, we will increase our knowledge, expertise and practical experience through the following objectives:
   - Create a multi-modal resource library that includes items like articles, white papers, success stories, webinars and tip sheets
   - Showcase Alberta examples of projects that successfully incorporate learning healthcare system principles
   - Invite external experts from recognized institutions to provide practical advice to our network and speak at larger network meetings
   - Include education sessions at CC SCN core team meetings and other network- and department-level meetings.
2. We will ensure the regular use of existing critical care data assets and clinical analytics reporting tools by:
   - Creating awareness of these resources, including both existing reporting tools and the data query process
   - In collaboration with eCritical Alberta, creating data dictionaries for existing data assets
   - Building analytical capacity, including data literacy and utilization.
3. We will undertake several analytics demonstration projects to better understand our current care practices and performance, relative to existing best practices. We will achieve this goal through the following objectives:
   - Showcase recent projects incorporating province-wide analytics
   - Undertake “Did You Know” projects to further demonstrate analytics capabilities to the critical care community. The emphasis will be on unit-to-unit variation in practice or performance in projects, to capitalize on variation-based learning.
   - In collaboration with our research and informatics partners, plan and implement test cases that use learning healthcare system methods to answer focused care questions on critical care in Alberta
   - Seek seed grant funding to facilitate this work.
4. We plan to incorporate learning healthcare system goals and objectives into CC SCN projects and partnered research grants.

Maturing as a learning healthcare system: Indicators of success

We will use the following markers to gauge our level of maturity as a learning healthcare system:

- Critical care medical and operational leaders and quality improvement consultants routinely use eCritical analytics reports to evaluate the operations and performance of ICUs. The data gathered from eCritical informs decisions, policies and planning whenever possible.

- The critical care community better understands the variations in care that exist among Alberta ICUs, identifies with greater accuracy the unwanted portion of those variations, and takes steps to reduce modifiable variations through quality improvement projects
- Our community uses the learning healthcare system methodology to answer focused care questions about critical care in Alberta
- More clinician scientists and researchers leverage our informatics infrastructure (eCritical Alberta) for research projects and quality improvement
- We see an increase in the number of grants awarded that leverage our informatics infrastructure (eCritical Alberta)
- More peer-reviewed publications leverage our informatics infrastructure (eCritical Alberta).

Strategic direction 4: Building critical care and CC SCN identity

To achieve our goals, the CC SCN needs to build a stronger identity internally and externally. We have worked hard to evolve a provincial culture of improvement among patients and families, frontline staff, and leaders, and we can achieve even more if we work together as a cohesive team, harnessing our diverse strengths. To that end, we need to increase awareness of the role the CC SCN plays within critical care and improve communications and engagement among our network members and stakeholders. In addition, we need to increase awareness of critical care, ensuring that the public and our partners in health administration and government fully understand the integral role of critical care in patients' wellness journeys.

Building our identity: Why is this important?

Critical care can mean the difference between life and death to many patients, so it's vital that we work cohesively, and it's vital that our stakeholders appreciate the necessity of our work.

The health system depends heavily on critical care: our teams give fundamental support to emergency departments, operating theatres, and to those in need of advanced life support across a broad range of services. Our ability to champion our identity within the

health system will continue to ensure that critical care is positioned to meet current needs and future demand.

Building our identity: Future plans

As we in critical care mature as a learning healthcare system, our teams will be increasingly recognized for our knowledge and expertise, sharpening our identity and reputation. However, we recognize that the success of this strategic direction and the others outlined in this Transformational Roadmap will only be fully achieved if patients and families feel truly heard and involved, and if frontline professionals feel empowered to identify what needs to be done and do it. While we wish to reach all people of Alberta as we build our identity, these specific groups are inherent to our network's continued success.

"My experience as a patient advisor volunteering within AHS and the Critical Care SCN started in 2015. Through my healthcare journey, which includes a lengthy stay in ICU and a couple of surgeries, I have experienced true patient- and family-centred care, and times where that was a struggle. I am passionate about helping to make things better for patients and families by sharing my lived experience and perspectives on how to do so. I strongly believe that communication—genuinely listening to what patients and families are saying and involving us in care planning, including discharges and transitions—is key to patient- and family-centred care."

Shelly Kupsch, patient advisor

To further champion the value of critical care in Alberta and create increased understanding of the network's benefit and impact, we will work with our partners to achieve the following:

- Position ourselves as recognized leaders in research, innovation and quality through the advancement of our learning healthcare system
- Advocate the value of the CC SCN and critical care community as partners in pan-SCN and cross-sectoral initiatives, and increase awareness of our value among current and alternate funders
- Build public awareness about critical care in Alberta, informing our audiences about patient populations, outcomes, informatics resources, quality improvement strategies and success stories. To that end we will create publications, infographics and social media campaigns.

Building our identity: Indicators of success

We will know we've elevated our profile within AHS and in the public when the following changes occur:

- The magnitude and value of critical care in Alberta is more widely recognized internally and externally
- A greater number of patients, families and frontline healthcare professionals engage in network projects and activities
- The critical care community increases its success rates for partnered grant applications and funding awards, including funding from alternative funding sources
- Our teams increase their community and internal exposure through conference presentations, abstracts, publications and virtual town halls.

Conclusion

Looking forward and next steps

The CC SCN's Transformational Roadmap is designed to engage Alberta critical care healthcare professionals, patients, and communities in supporting innovative ideas. As we mature into a learning healthcare system, we will work together to transform Alberta's health system.

Through our culture of providing evidence-based quality care, we in Alberta's critical care community will continue to identify creative and innovative approaches to our work. We will aim to improve the following:

- Patient and family experiences
- Patient and population health outcomes
- The experience and safety of our people
- The financial health of AHS and sustainability of our health system overall

In its short history as a network, the CC SCN has made significant progress in resolving issues that affect critically ill patients across the province, and our achievements make our healthcare system more sustainable. Our network will continue to pursue work that puts patients first, supports operational decisions, drives quality improvement and generates novel ideas. This Transformational Roadmap will help the critical care community support the people of Alberta and their families as they encounter some of the most intense moments of their health journeys.

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Appendix 1

CC SCN Core Committee

Name	Position / Role	Organization / Zone
Kimberley Simmonds	Executive Director, Health System Planning & Quality Branch Health	Alberta Health
Jamie Tycholiz	Nurse Consultant, HHR Applied Research and Education	Alberta Health
Laura Slipp	Patient Care Manager, PICU, NICU, Neonatal Follow Up Clinic, Alberta Children's Hospital	Calgary Zone
Tom Stelfox	Professor & Head, Department of Critical Care Medicine University of Calgary & Alberta Health Services	Calgary Zone
Emma Folz	Executive Director, Administration, Critical Care Ops Lead.	Calgary Zone
Kirsten Fiest	Assistant Professor, Departments of Critical Care Medicine and Community Health Sciences	University of Calgary
D'Arcy Duquette	Patient Advisor	N/A – Calgary Zone
Simone Chalifoux	Family Advisor	N/A – Edmonton Zone
Adam Hall	Intensivist, Red Deer Regional Hospital Centre Assistant Adjunct Professor, Department of Critical Care Medicine FOMD UAH	Central Zone
Kelly Longard	Director, Cardiac Sciences, Critical Care & Respiratory Red Deer Regional Hospital	Central Zone
Shelley Duggan	Zone Clinical Department Head, Department of Critical Care Medicine	Edmonton Zone
Donalda Dyjur	Executive Director, Medicine and Critical Care, Royal Alexandra Hospital	Edmonton Zone

Lisa Cote	Patient Care Manager, PCICU/ECMO/CCFP, Stollery Children's Hospital	Edmonton Zone
Dominic Cave	Pediatric Cardiac Intensivist, PCICU, Stollery Children's	Edmonton Zone
Teddie Tanguay	Nurse Practitioner, Critical Care, Royal Alexandra Hospital	Edmonton Zone
Laurie Sembaliuk	Program Manager, Critical Care and Cardiac Sciences, Grey Nuns Community Hospital (GNCH)	Covenant Health
Dominic Carney	Medical Director ICU, GNCH	Covenant Health
Oleksa Rewa	Clinical Scholar, Department of Critical Care Medicine	University of Alberta
Sherry Reid	Executive Director, Anesthesia, Endoscopy, Trauma & Surgery Inpatient, University of Alberta Hospital	Edmonton Zone
Sandra Beida	Manager ICU/Respiratory/Cardiology, Queen Elizabeth II Hospital, Grande Prairie	North Zone
Tafi Madzimure	Medical Director Critical Care, QE II Grande Prairie	North Zone
Roberta Dubois	Practice Director, Provincial Respiratory Services, Health Professions Strategy & Practice	Health Professions Strategy & Practice
Marilyn Bartoshyk	Director, Cardiac Sciences, Respiratory & Critical Care	South Zone
Tracey Geyer	Senior Planner, Planning and Performance	Planning &
Sean Spence	Intensivist, Critical Care Physician representative, CRH	South Zone
Darren Hudson	Medical Director, eCritical Alberta	Provincial
Dan Zuege	Senior Medical Director	CC SCN
Nancy Fraser	Senior Provincial Director	CC SCN
Sherri Kashuba	Executive Director	CC SCN
Jeanna Morrissey	Manager	CC SCN
Sean Bagshaw	CC SCN Scientific Director & Chair of the Department of Critical Care Medicine, University of Alberta	CC SCN
Samantha Bowker	Assistant Scientific Director	CC SCN
Jo Harris	Senior Analytics and Project Consultant	CC SCN

Past Core Committee members who contributed to development of the TRM include:

Name	Position / Role	Organization / Zone
Caroline Hatcher	Executive Director, Cardiac Sciences, Neurosciences & Critical Care, Foothills Medical	Calgary Zone
Ernie Janzen	Medical Director, ICU/CCU, Chinook Regional Hospital	South Zone
Patricia O'Toole	Program Manager, Critical Care, Misericordia Community Hospital	Covenant Health / Edmonton Zone
Colleen Sokolowski	Intensivist, Red Deer Regional Hospital Centre	Central Zone

Appendix 2

Sample screenshots—critical care KPI (key performance indicator) dashboard

The critical care KPI dashboard shows various key performance indicators with separate tabs for specific indicators.

The dashboard can be viewed by type (Adult-CCU/CICU, CVICU, ICU, Pediatrics-CICU, ICU), zone (Calgary, Edmonton, Regional) or by individual site.

Figure 1A. Critical care KPI dashboard—summary tab, adult ICU

Summary | Mortality | Night Discharge | Readmit | Avoidable Days | Occupancy | Patient Goals | First Family Contact | Site Comparisons | Notes & Definitions

Alberta Health Services

Critical Care KPI Dashboard

eCritical ALBERTA

Type: Adult ICU | Zone: (All) | Site: (All)

01-Apr-18 — 31-Mar-19

Discharges

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Discharges	817	872	835	803	893	805	898	819	903	843	745	870

Critical Care and Hospital Mortality

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Critical Care Mortality %	12.6%	13.8%	13.5%	11.7%	11.6%	15.9%	11.9%	15.4%	13.2%	14.5%	13.2%	13.9%
Hospital Mortality %	17.9%	19.3%	18.1%	15.2%	15.3%	19.0%	16.3%	19.4%	19.0%	20.2%	18.4%	18.2%

Critical Care Nighttime Discharges

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Live Discharge 19:00 to 23..	12.5%	12.6%	11.4%	9.3%	12.7%	10.9%	14.6%	13.9%	13.8%	14.8%	13.7%	13.3%
Live Discharge 19:00 to 7:..	16.8%	16.7%	15.6%	14.2%	17.5%	16.3%	21.7%	18.8%	18.1%	19.5%	17.9%	17.6%
Live Discharge 23:00 to 7:..	4.3%	4.1%	4.2%	4.9%	4.8%	5.3%	7.1%	4.9%	4.2%	4.6%	4.2%	4.3%

Critical Care Readmissions

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Readmit Within 24 Hours %	0.5%	0.8%	0.4%	1.2%	0.9%	0.7%	0.8%	0.6%	0.6%	0.8%	0.7%	0.6%
Readmit Within 48 Hours %	2.0%	1.4%	1.1%	2.0%	1.3%	1.2%	1.1%	1.2%	2.4%	1.5%	1.1%	1.4%
Readmit Within 72 Hours %	2.3%	1.9%	1.3%	2.4%	1.5%	1.4%	1.6%	2.0%	3.5%	2.3%	2.3%	2.2%
Hospital Index Readmit %	3.9%	4.0%	3.2%	5.0%	3.5%	3.7%	4.1%	4.5%	4.8%	5.5%	5.1%	4.5%

Critical Care Avoidable Days

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Avoidable Days %	12.6%	11.6%	11.4%	12.8%	13.1%	12.1%	11.4%	10.0%	7.3%	9.8%	13.6%	13.0%

Critical Care Occupancy

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Mean Occupancy % Actual	84.7%	81.6%	77.8%	78.0%	82.1%	81.1%	86.2%	88.1%	89.9%	87.8%	83.0%	85.3%
Mean Occupancy % CIHI	83.5%	80.6%	76.9%	76.9%	81.1%	80.1%	84.9%	87.1%	88.6%	86.8%	81.8%	83.9%
Min Occupancy % Actual	73.5%	71.4%	67.7%	66.7%	74.6%	73.0%	78.3%	77.8%	81.5%	78.3%	74.6%	75.1%
Max Occupancy % Actual	92.6%	95.2%	86.2%	89.9%	94.2%	91.0%	96.3%	100.0%	98.9%	98.4%	92.1%	95.8%
Percentage of Days >= 100..								0.1%				

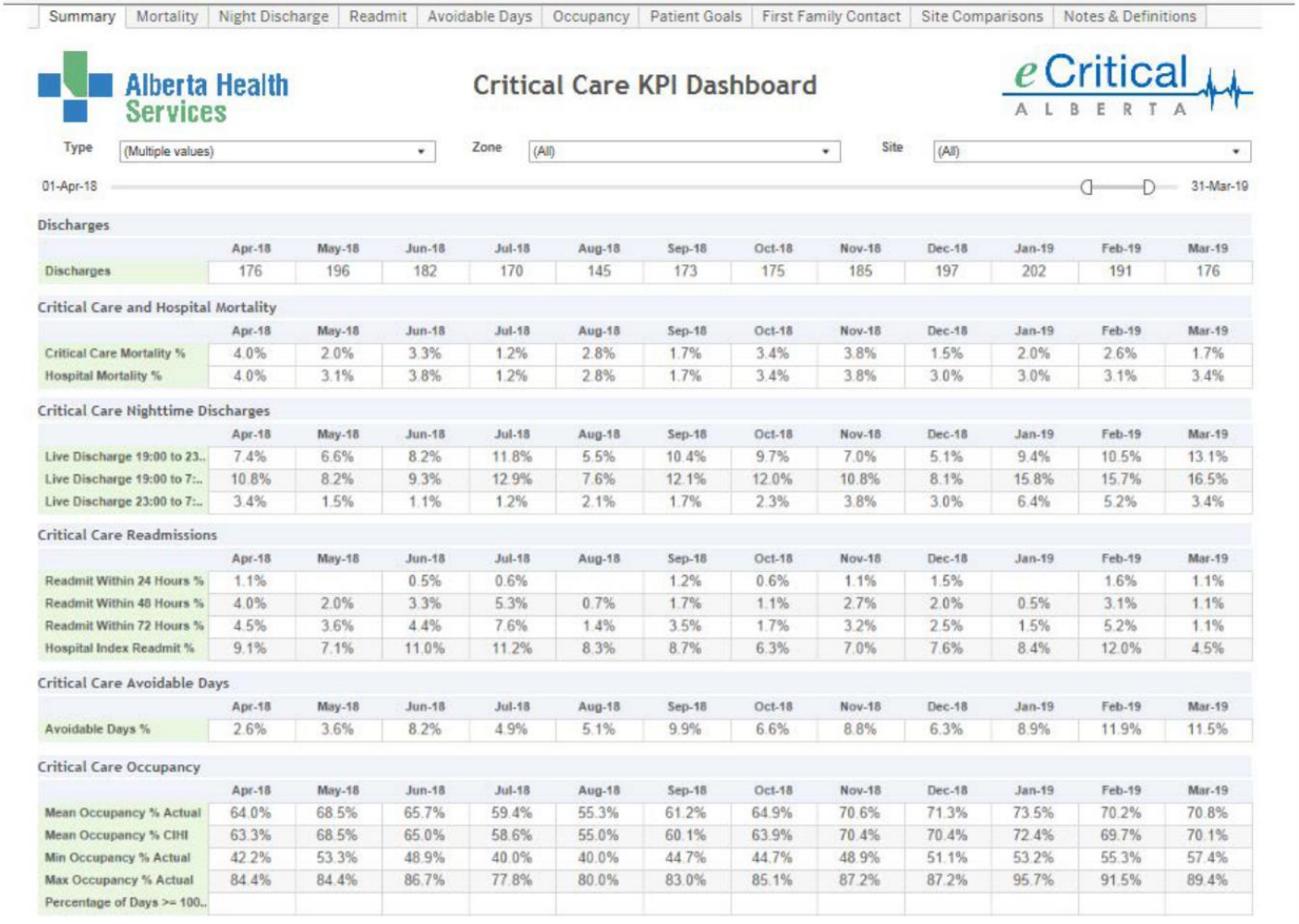
Patient Goals

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Discharges With Goals %	25.6%	27.5%	27.8%	29.8%	30.2%	29.9%	28.8%	29.2%	29.9%	29.8%	27.1%	29.0%
Goals Documented Daily %	25.2%	24.0%	26.1%	25.1%	26.0%	23.9%	25.6%	26.3%	26.5%	27.2%	25.2%	25.9%

First Family Contact

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Eligible Admit	398	451	424	443	448	418	487	470	475	439	408	454
Contact First 30 Min %	43.2%	42.1%	38.4%	38.6%	35.7%	39.2%	43.9%	44.5%	41.7%	46.0%	44.6%	44.3%
In-Person Contact %	71.9%	68.1%	66.0%	64.6%	66.5%	70.3%	70.2%	62.8%	62.1%	67.0%	69.6%	64.5%
Telephone Contact %	27.1%	29.9%	31.1%	33.6%	31.3%	28.2%	28.1%	35.7%	36.4%	31.4%	28.7%	33.5%

Figure 1B. Critical Care KPI Dashboard – Summary tab, Pediatrics



Summary | Mortality | Night Discharge | Readmit | Avoidable Days | Occupancy | Patient Goals | First Family Contact | Site Comparisons | Notes & Definitions

Alberta Health Services

Critical Care KPI Dashboard

eCritical ALBERTA

Type: (Multiple values) Zone: (All) Site: (All)

01-Apr-18 — 31-Mar-19

Discharges

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Discharges	176	196	182	170	145	173	175	185	197	202	191	176

Critical Care and Hospital Mortality

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Critical Care Mortality %	4.0%	2.0%	3.3%	1.2%	2.8%	1.7%	3.4%	3.8%	1.5%	2.0%	2.6%	1.7%
Hospital Mortality %	4.0%	3.1%	3.8%	1.2%	2.8%	1.7%	3.4%	3.8%	3.0%	3.0%	3.1%	3.4%

Critical Care Nighttime Discharges

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Live Discharge 19:00 to 23..	7.4%	6.6%	8.2%	11.8%	5.5%	10.4%	9.7%	7.0%	5.1%	9.4%	10.5%	13.1%
Live Discharge 19:00 to 7:..	10.8%	8.2%	9.3%	12.9%	7.6%	12.1%	12.0%	10.8%	8.1%	15.8%	15.7%	16.5%
Live Discharge 23:00 to 7:..	3.4%	1.5%	1.1%	1.2%	2.1%	1.7%	2.3%	3.8%	3.0%	6.4%	5.2%	3.4%

Critical Care Readmissions

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Readmit Within 24 Hours %	1.1%		0.5%	0.6%		1.2%	0.6%	1.1%	1.5%		1.6%	1.1%
Readmit Within 48 Hours %	4.0%	2.0%	3.3%	5.3%	0.7%	1.7%	1.1%	2.7%	2.0%	0.5%	3.1%	1.1%
Readmit Within 72 Hours %	4.5%	3.6%	4.4%	7.6%	1.4%	3.5%	1.7%	3.2%	2.5%	1.5%	5.2%	1.1%
Hospital Index Readmit %	9.1%	7.1%	11.0%	11.2%	8.3%	8.7%	6.3%	7.0%	7.6%	8.4%	12.0%	4.5%

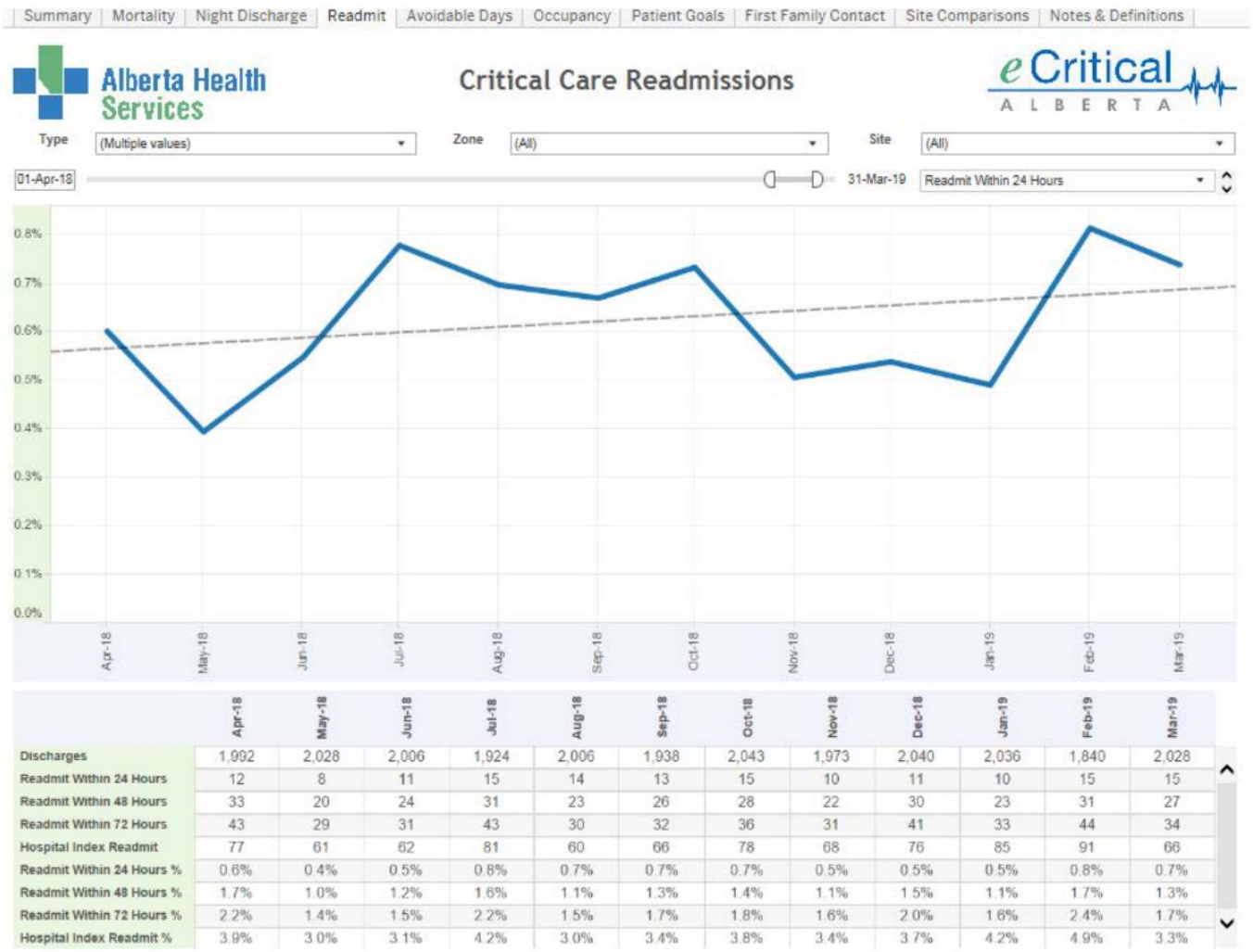
Critical Care Avoidable Days

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Avoidable Days %	2.6%	3.6%	8.2%	4.9%	5.1%	9.9%	6.6%	8.8%	6.3%	8.9%	11.9%	11.5%

Critical Care Occupancy

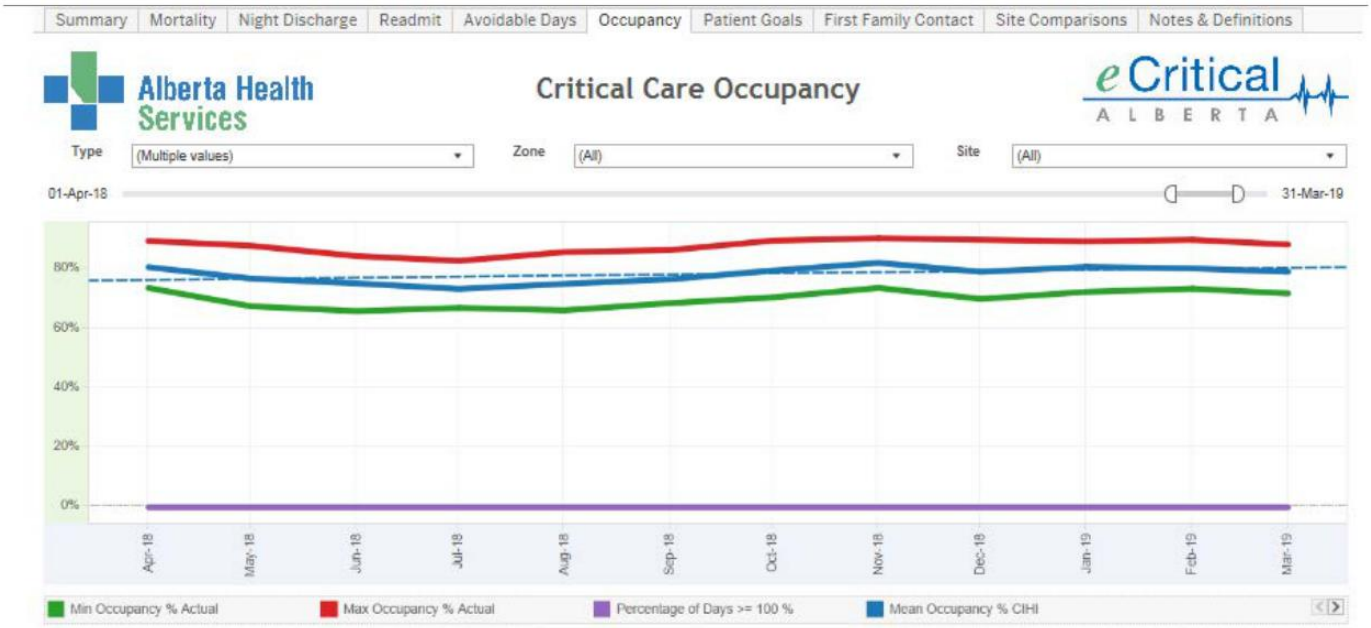
	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Mean Occupancy % Actual	64.0%	68.5%	65.7%	59.4%	55.3%	61.2%	64.9%	70.6%	71.3%	73.5%	70.2%	70.8%
Mean Occupancy % CIHI	63.3%	68.5%	65.0%	58.6%	55.0%	60.1%	63.9%	70.4%	70.4%	72.4%	69.7%	70.1%
Min Occupancy % Actual	42.2%	53.3%	48.9%	40.0%	40.0%	44.7%	44.7%	48.9%	51.1%	53.2%	55.3%	57.4%
Max Occupancy % Actual	84.4%	84.4%	86.7%	77.8%	80.0%	83.0%	85.1%	87.2%	87.2%	95.7%	91.5%	89.4%
Percentage of Days >= 100..												

Figure 2. Critical Care KPI Dashboard - Readmissions



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Discharges	1,992	2,028	2,006	1,924	2,006	1,938	2,043	1,973	2,040	2,036	1,840	2,028
Readmit Within 24 Hours	12	8	11	15	14	13	15	10	11	10	15	15
Readmit Within 48 Hours	33	20	24	31	23	26	28	22	30	23	31	27
Readmit Within 72 Hours	43	29	31	43	30	32	36	31	41	33	44	34
Hospital Index Readmit	77	61	62	81	60	66	78	68	76	85	91	66
Readmit Within 24 Hours %	0.6%	0.4%	0.5%	0.8%	0.7%	0.7%	0.7%	0.5%	0.5%	0.5%	0.8%	0.7%
Readmit Within 48 Hours %	1.7%	1.0%	1.2%	1.6%	1.1%	1.3%	1.4%	1.1%	1.5%	1.1%	1.7%	1.3%
Readmit Within 72 Hours %	2.2%	1.4%	1.5%	2.2%	1.5%	1.7%	1.8%	1.6%	2.0%	1.6%	2.4%	1.7%
Hospital Index Readmit %	3.9%	3.0%	3.1%	4.2%	3.0%	3.4%	3.8%	3.4%	3.7%	4.2%	4.9%	3.3%

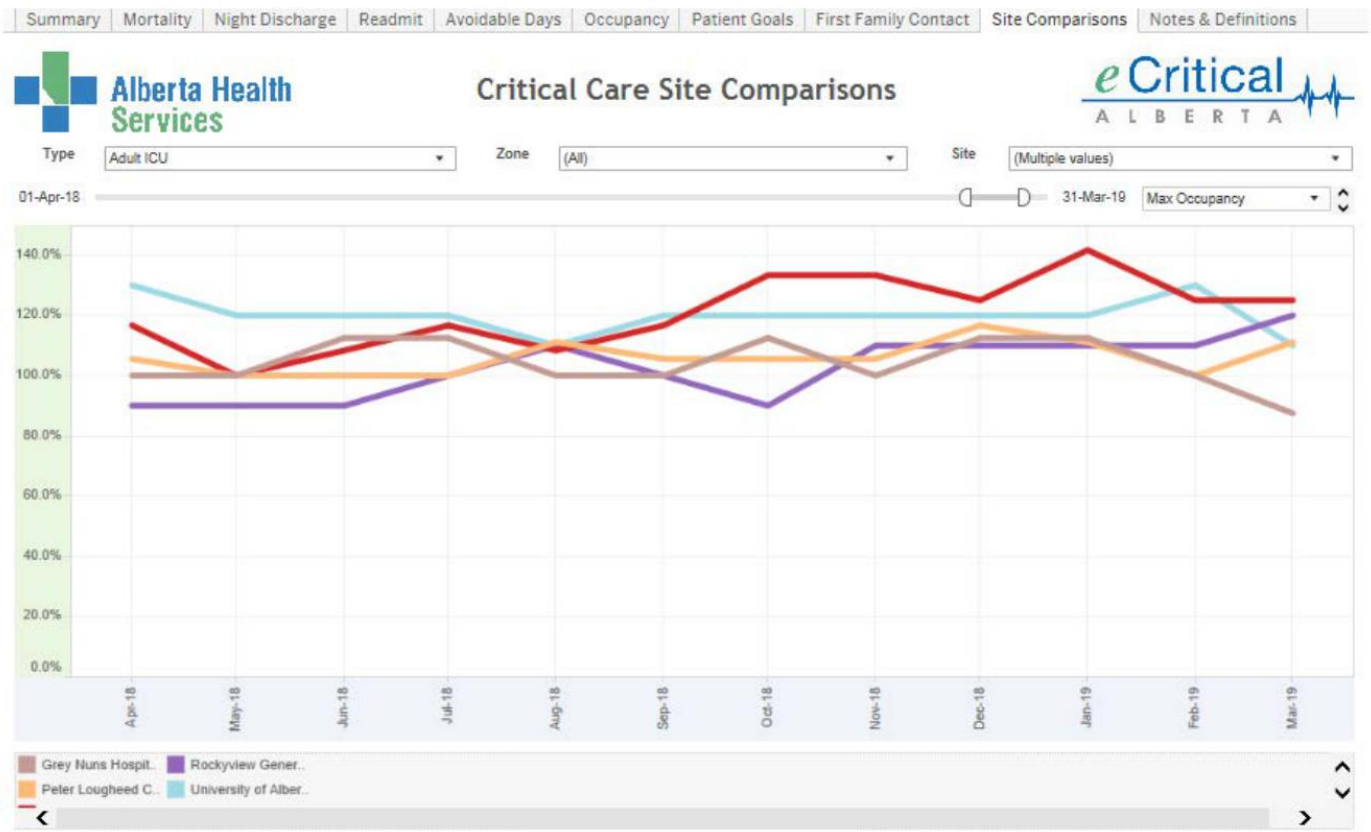
Figure 3. Critical Care KPI Dashboard – Occupancy tab



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Mean Funded Beds	373.0	373.0	373.0	373.0	373.0	376.5	377.0	377.0	377.0	377.0	377.0	377.0
Mean Actual Occupancy	304.3	289.0	283.2	276.8	282.2	290.9	303.3	311.8	301.6	307.4	305.2	302.2
Mean CIHI Occupancy	301.1	286.8	280.7	273.8	280.2	288.6	300.0	309.8	298.4	304.6	302.7	298.5
Min Occupancy	275	252	246	250	247	256	266	278	264	273	277	271
Max Occupancy	334	328	315	309	320	326	338	341	339	337	339	333
Mean Occupancy % Actual	81.6%	77.5%	75.9%	74.2%	75.7%	77.3%	80.4%	82.7%	80.0%	81.5%	81.0%	80.2%
Mean Occupancy % CIHI	80.7%	76.9%	75.3%	73.4%	75.1%	76.7%	79.6%	82.2%	79.1%	80.8%	80.3%	79.2%
Min Occupancy % Actual	73.7%	67.6%	66.0%	67.0%	66.2%	68.6%	70.6%	73.7%	70.0%	72.4%	73.5%	71.9%
Max Occupancy % Actual	89.5%	87.9%	84.5%	82.8%	85.8%	86.5%	89.7%	90.5%	89.9%	89.4%	89.9%	88.3%
Number of Days >= 100 %												
Percentage of Days >= 100 %												
Hours at Min	5.1	2.3	7.9	1.1	4.0	1.7	5.1	4.5	2.2	1.1	11.9	6.8
Hours at Max	27.8	48.2	4.6	160.4	2.8	0.6	7.4	19.9	5.7	19.3	25.5	24.4

Figure 4. Critical Care KPI Dashboard – Site Comparison tab

This tab allows data for specific metrics to be compared across sites.



Appendix 3

Research and knowledge translation activities

Following are some key research projects currently being pursued by Alberta's critical care community:

Collaborative research grants (selected examples):

ICU Capacity Strain

The ICU Capacity Strain program is exploring issues related to the strained ICU capacity in Alberta. The goal is to improve access to, and efficiency of, ICU care and, ultimately, improving ICU quality of care and outcomes. PI: Sean Bagshaw. PRIHS Grant 2014, $743,000. Alberta Innovates/AHS.

Evidence-Care Gaps

The Evidence-Care Gaps program aimed to improve patient outcomes by closing measurable gaps in evidence-based care. Several CC SCN priorities, including delirium best practices and Transitions in Care, emerged from this program. Its research identified and prioritized opportunities for improvement based on engagement of ICU providers, and patients and families. Prophylaxis against deep venous thrombosis in ICU patients was optimized province-wide via knowledge translation initiatives from this work. PI: Tom Stelfox. PRIHS Grant 2014, $748,000. Alberta Innovates/AHS.

Reducing the Use of Blood Products

Several parallel projects funded by a variety of grants are underway to rationalize the use of albumin and red blood cell transfusions in critically ill patients. This program directly affects the use of these valuable blood products in a high-use population. It also aims to evolve knowledge translation methods that are generalizable to other care

practices in ICU environments, helping to mature our critical care community as a learning healthcare system.

PI: Dan Niven. CIHR Project and Catalyst Grants: 2018/2019, $393,974 and $98,312. Choosing Wisely Alberta Grant: 2019, $99,631.

Family Identification of Delirium in ICU Patients

These programs develop and evaluate the ability of family members of ICU patients to detect delirium and aid in the non-pharmacologic prevention and management of delirium if it evolves. PI: Kirsten Fiest. CIHR Project Grant: 2018, $428,400. Canadian Frailty Network: 2018, $100,000.

Transitions in Care

This program involves co-designing and implementing a patient and family caregiver-oriented transitions in care bundle to apply to critically ill patients. PI: Kristen Fiest. CIHR Team Grant: 2019, $948,000.

Stress Ulcer Prophylaxis

This program implements a pragmatic, cluster-randomized crossover, registry-embedded clinical trial of proton pump inhibitors, versus histamine-2 receptor blockers for stress ulcer prophylaxis therapy, in critically ill patients (the PEPTIC study) throughout Alberta. This trial uses an innovative design where units are randomized to one of two standard of care therapies already widely used in Alberta. The goal is to identify a best practice approach, from the perspective of patient outcomes and economics. PI: Sean Bagshaw. CIHR Project Grant: 2018, $317,475.

Timing of Dialysis Therapies in ICU Patients

Standard versus accelerated initiation of renal replacement therapy in acute kidney injury (the STARRT-AKI trial). This multi-centre trial compares earlier and later initiation of dialysis therapies in ICU patients. PI: Sean Bagshaw. CIHR Project Grant: 2018, $1,556,776.

High-impact publications (selected examples)

The following are publications where the CC SCN had a role:

1. Rewa OG, Eurich DT, Stelfox HT, Gibney N, Hartling L, Featherstone R, Bagshaw SM. Quality indicators in continuous renal replacement therapy (CRRT) care in critically ill patients: a systematic review. Intensive Care Med. Intensive Care Med. 2017 Jun;43(6):750-763.
2. Rewa OG, Eurish DT, Gibney RTN, Bagshaw SM. 2018. A modified Delphi process to identify, rank, and prioritize quality indicators for continuous renal replacement therapy (CRRT) care in critically ill patients. J Crit Care, 47:145-152.
3. Bagshaw SM, Opgenorth D, Potestio M, Hastings SE, Hepp SL, Gilfoyle E, McKinlay D, Boucher P, Meier M, Parsons-Leigh J, Gibney RT, Zygun DA, Stelfox HT. Healthcare Provider Perceptions of Causes and Consequences of Intensive Care Unit Capacity Strain in a Large Publicly-Funded Integrated Health Region: A Qualitative Study. Crit Care Med. 2017 Apr;45(4):e347-e356.
4. Sauro K, Bagshaw SM, Niven D, Soo A, Brundin-Mather R, Parsons-Leigh J, Cook DJ, Stelfox HT. 2019 Mar 15. Barriers and facilitators to adopting high-value practices and de-adopting low-value practices in Canadian intensive care units: a multimethod study. BMJ Open, 9(3):e024159.
5. de Grood C, Leigh JP, Bagshaw SM, Dodek PM, Fowler RA, Forster AJ, Boyd JM, Stelfox HT. 2018 Jun 4. Patient, family and provider experiences with transfers from intensive care unit to hospital ward: a multi-centre qualitative study. CMAJ,190(22):E669-E676.
6. Stelfox HT, Soo A, Niven DJ, Fiest KM, Wunsch H, Rowan KM, Bagshaw SM. 2018 Oct. Assessment of the Safety of Discharging Select Patients Directly Home from the Intensive Care Unit: A Multicenter Population-Based Cohort Study. JAMA Intern Med, 178(10):1390-1399.
7. Young PJ, Bagshaw SM, Forbes A, Nichol A, Wright SE, Bellomo R, Bailey MJ, Beasley RW, Eastwood GM, Festa M, Gattas D, van Haren F, Litton E, Mouncey PR, Navarra L, Pilcher D, Mackle DM, McArthur CJ, McGuinness SP, Saxena MK, Webb S, Rowan KM; Australian and New Zealand Intensive Care Society Clinical Trials Group on behalf of the PEPTIC investigators. 2018 Sep. A cluster randomized, crossover, registry-embedded clinical trial of proton pump inhibitors versus histamine-2 receptor blockers for ulcer prophylaxis therapy in the intensive care unit (PEPTIC study): study protocol. Crit Care Resusc, 20(3):182-189.
8. Tran DT, Thanh NX, Opgenorth D, Wang X, Zuege D, Zygun DA, Stelfox HT, Bagshaw SM. 2019 Feb 26. Association between strained ICU capacity and health care costs in Canada: a population-based cohort study. J Crit Care, 51:175-183.
9. Opgenorth D, Stelfox HT, Gilfoyle E, Gibney RTN, Meier M, Boucher P, McKinlay D, Job McIntosh CN, Wang X, Zygun DA, Bagshaw SM. 2018 Aug 22. Perspectives on strained intensive care unit capacity: A survey of critical care professionals. PLoSOne,13(8):e0201524. PMID: 30133479

10. Papathanassoglou EDE, Skrobik Y, Hegadoren K, Thompson P, Stelfox HT, Norris C, Rose L, Bagshaw sm, Meier M, LoCicero C, Ashmore R, Sparrow Brulotte T, Hassan I, Park T, Kutsogiannis DJ. 2019 Jan 15. Relaxation for critically ill patient outcomes and stress-coping enhancement (REPOS): a protocol for a pilot randomized trial of an integrative intervention to improve critically ill patients' delirium and related outcomes. BMJ Open, 9(1):e023961.
11. Krewulak KD, Sept BG, Stelfox HT, Ely EW, Davidson JE, Ismail Z, Fiest KM. Feasibility and acceptability of family administration of delirium detection tools in the intensive care unit: a patient-oriented pilot study. CMAJ Open 2019;7(2):E294-E299.
12. Stelfox HT, Niven DJ, Clement FM, Bagshaw SM, Cook DJ, McKenzie E, Potestio ML, Doig CJ, O'Neill B, Zygun D; Critical Care Strategic Clinical Network, Alberta Health Services. Stakeholder engagement to identify priorities for improving the quality and value of critical care. PloS One. 2015 Oct 22;10(10):e0140141.