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Creating Value Through Learning Health Systems

The Alberta Strategic Clinical Network Experience

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Design, implementation, and evaluation of effective multicomponent interventions typically take decades before value is realized even when value can be measured. Value-based health care, an approach to improving patient and health system outcomes, is a way of organizing health systems to transform outcomes and achieve the highest quality of care and the best possible outcomes with the lowest cost. We describe 2 case studies of value-based health care optimized through a learning health system framework that includes Strategic Clinical Networks. Both cases demonstrate the acceleration of evidence to practice through scientific, financial, structural administrative supports and partnerships. Clinical practice interventions in both cases, one in perioperative services and the other in neonatal intensive care, were implemented across multiple hospital sites. The practical application of using an innovation pipeline as a structural process is described and applied to these cases. A value for money improvement calculator using a benefits realization approach is presented as a mechanism/tool for attributing value to improvement initiatives that takes advantage of available system data, customizing and making the data usable for frontline managers and decision makers. Health care leaders will find value in the descriptions and practical information provided. **Key words:** *clinical outcomes, implementation science, innovative health care models, learning health system, sustainability*

VALUE-BASED HEALTH CARE (VBHC) is becoming a leading approach to improve patient and health system outcomes around the world.[1] It is one way of organizing health care to transform health outcomes.[1] VBHC is about linking how much money is spent on health care programs or services

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over a patient's journey to the outcomes that matter most to patients—rather than focusing primarily on the number of services, or on specific processes or products.[2] As health systems emerge from the ravages of the COVID-19 pandemic, the fundamental shift to VBHC is more critical than ever.[3] VBHC endeavors to achieve the highest quality of care and best possible outcomes with the lowest cost.[4] In Alberta, the pursuit of greater value in health care is intrinsically embedded within its integrated learning health system (LHS) to optimize outcomes and achieve the Quadruple Aim.[5] Alberta is a province in western Canada that delivers health care services to 4.5 million people through a single, integrated health system. Canada has publicly funded health care with transfer payments, policies, and practices controlled and managed by each of the 10 provinces and 3 territories.[6] The Quadruple Aim is a framework for achieving VBHC and includes (*a*) patient experience, (*b*) provider experience, (*c*) population health, and (*d*) health costs.[7] The Strategic Clinical Networks (SCNs) are a fundamental infrastructure and mechanism for driving innovation and improvement across Alberta's health system.[8] Operationalized through SCNs and Alberta Health Services (AHS) Health Evidence and Innovation program; an "Innovation Pipeline" provides the structure to guide the design, deployment, and evaluation of innovation across the health system. The Innovation Pipeline is a defined process SCNs use to translate evidence into care by enabling rapid, rigorous, and efficient evaluation and implementation. It is built on the principles of quality, safety, and use of the best research to help patients, health care providers, and the health care system work at its best. The purpose of this article is to describe how an LHS accelerates evidence to practice through well-designed processes and partnerships to create value for patients, families, and the health system. First, we describe an LHS, SCNs, and the AHS Innovation Pipeline. Next, we provide exemplars of 2 successful initiatives: Enhanced Recovery After Surgery (ERAS) and Alberta Family Integrated Care (FICare). We conclude with recommendations for nursing administrators charged with strengthening innovation while maintaining efficiencies and controlling costs in their health systems.

LEARNING HEALTH SYSTEMS

LHSs can be considered a key strategy for improving value in health care and have emerged as a mechanism for advancing science and practice with an aim of improving the health system performance and lowering costs.[7] Value is the goal of an LHS with optimized and acceptable balance across the 4 outcomes of patient experience, population health, provider experience, and health system costs. Learning cycles are at the heart of LHSs, while infrastructures support the implementation of learning cycles.[7] An LHS can be thought of as a dynamic ecosystem of change enabling learning through a strategically designed infrastructure and approach that includes iterative data to advance the knowledge to practice cycle, supported by infrastructure, systems, and resources that provide foundational supports for the LHS. Social, science, technological, policy, legal, and ethical supports (pillars) are critical to an LHS,[7] because they provide the organization, policies, and funding sources needed to accelerate learning. Core values (ie, adaptability, participatory leadership, equity, inclusiveness, open innovation, person focused, privacy, scientific integrity, shared accountability, solidarity, and transparency) underpinning an LHS reflect the ingredients needed to move from a reactive to proactive health system, where a learning improvement culture is embedded across the system and can take action to address challenges and capitalize on opportunities.[7] Structures and accelerators to support Alberta's LHS have evolved over time with empirical evidence of their ability to impact population outcomes. Key to this evolution have been the SCNs.

STRATEGIC CLINICAL NETWORKS

In existence since 2012, AHS's SCNs[9] reflect the goals, processes, pillars, and values of an LHS.[7] The SCNs were built on multidisciplinary partnerships, including patients, families, and the public, designed to identify gaps in patient care and outcomes and move evidence into practice. There are currently 11 SCNs and 5 Integrated Provincial Programs in AHS that reflect populations (Maternal Newborn Child and Youth, Seniors Health, Addictions and Mental Health, Indigenous Wellness Core, Population and Public Health, and Primary Care), disease/health areas (Cancer, Diabetes Obesity and Nutrition, Cardiovascular Health and Stroke, Digestive Health, Neurosciences, Rehabilitation and Vision), or high cost/utilization services (Surgery, Medicine, Emergency, Critical Care). Embedded within SCNs are the values underpinning an LHS[7] including participatory leadership, inclusiveness, transparency, and solidarity that empowers stakeholders through shared priority setting and codesign among network members including patients, operational leaders, clinicians, and researchers to name a few. Equity is an overarching value through gap identification and a goal of reduced variation in care and patient outcomes. Scientific integrity and open innovation are key values that are enhanced through academic partnerships and a scientific office as part of the core infrastructure of each SCN. The SCNs have matured over time and represent a collaborative partnership model that is addressing health care and system challenges to bring about transformational change.[10] Collectively, they are providing value in all 4 quadrants of outcomes expected from an LHS.[7] While Menear and colleagues[7] described processes (ie, data to knowledge, knowledge to practice, and practice to data) associated with outcomes, Alberta's SCNs have designed and operationalized details of this process into an Innovation Pipeline (Figure 1).

INNOVATION PIPELINE

Alberta's Innovation Pipeline[11] is an intentional strategy aligned with the Quadruple Aim and outcomes of an LHS and is an important accelerator of the science pillar.[7] The goal of the Innovation Pipeline process is to support the "pull" of innovation into the system and to rigorously test and build the necessary evidence to make value-based funding decisions for sustainability. The Innovation Pipeline has transparent and predictable structures and processes that accelerate application of evidence to adoption.[11] Structures and processes are theoretically driven by change management, patient- and family-centered care, and implementation science frameworks. Critical to the process is a carefully laddered series of funding opportunities to finance 5 steps of adoption of new evidence.[11] The SCNs are embedded structures that form the starting point of adjudication of high-value, priority initiatives.[12]

In step 1 of the Innovation Pipeline,[11] clinicians and/or researchers identify a complex clinical problem that, if addressed, could improve patient and family outcomes and create measurable value for the health system. The problem may be aligned with existing health system strategic priorities or an

Figure 1. Alberta Health Services Innovation Pipeline. From Waye et al.[11] Used with permission.

emerging problem. Regardless, each SCN prioritizes the problems they intend to address, solutions are implemented, and then scaled for impact.[13] For example, during evaluation of an intervention in the Alberta context, the SCN facilitates access to current health administrative data to strengthen arguments for research operating grant applications. In a series of rigorous and transparent application review processes, the SCNs collaborate and support refinement of projects. In step 2, feasibility of potential solutions is tested in proof-of-concept studies often in a subset of clinics or hospitals to understand how to deliver and sustain solutions. In step 3, promising solutions are tested to demonstrate clinical effectiveness in multiple settings in Alberta. Step 4 is the deliberate and planned scale and spread of effective solutions across all relevant settings in the province. Finally, in step 5, solutions with evidence of clinical and cost-effectiveness that have been successfully adopted are considered for ongoing funding to sustain a return on investment (ROI). Throughout the Innovation Pipeline, the SCNs partner with researchers to navigate complicated structures and processes in Alberta's complex, integrated health system.[14] To leverage external operating grants from national and provincial funding bodies and foundations, SCN projects are eligible for competitive funding relevant to the stage of the project. For example, the Alberta Innovates Partnership for Research and Innovation in the Health System (PRIHS)[15] funds pragmatic implementation trials and quality improvement initiatives to evaluate the effectiveness of interventions in the Alberta context. If the intervention demonstrates that it can create measurable value, the project team may be invited to advance to the next stage of the pipeline and apply for Health Innovation Implementation and Spread (HIIS)[16] funding to scale and spread the intervention. Design, implementation, and evaluation of effective multiple component interventions in complex ecosystems are challenging and typically take decades.[17] The mechanisms of how SCNs use an LHS framework to actualize the Innovation Pipeline are illustrated in Figure 2. To give the readers a lived understanding of how these mechanisms work together, we describe 2 province wide initiatives as exemplars: ERAS and Alberta FICare.

ENHANCED RECOVERY AFTER SURGERY

Grounded in evidence from the United Kingdom[18] and the Netherlands,[19] led by the Diabetes, Obesity and Nutrition SCN and the Surgical SCN, AHS has implemented multiple ERAS[20] guidelines at 9 sites, including 3 major teaching hospitals, in 9 different program areas from orthopedics to breast cancer surgery including the initial demonstration project guideline for gastrointestinal surgical procedures.[21] ERAS consists of a series of practice strategies intended to mitigate adverse surgical outcomes. The ERAS practices include the following: enhanced nutrition, early mobilization, fluid management with modernized fasting guidelines including carbohydrate loading, and pain and symptom control.[22] Together, these practices when implemented with fidelity or compliance contribute to accelerated recovery, reduced complications, shortened length of stay (LOS), decreased readmission, and enhanced patient experience, all contributing to significant value in the Quadruple Aim goals.[23,24] Funding provided through Alberta Innovates PRIHS accelerated the opportunities to implement and evaluate ERAS in Alberta's integrated health system. A strong business case that was clear and compelling using Alberta data and modeling of potential impacts from other countries also included a comprehensive implementation plan that addressed barriers and facilitators in the Alberta context. Successful implementation strategies included surgical and anesthesia champions, standardized approaches to implementation, standardized patient and staff education, robust audit and feedback capability, a systems perspective, and a structured approach to communication.[21] An evaluation of the AHS program comparing pre-ERAS and post-ERAS cohorts for 5 ERAS surgical pathways (colorectal, liver, pancreas, gynecology oncology, and radical cystectomy) across 9

sites and 7757 patients demonstrated improved compliance to guidelines from 52% to 76%. There were no significant differences in serious complications or 30-day mortality. One-year mortality significantly decreased from 7.1% to 4.6%, with mean LOS also decreasing from 9.4 days to 7.8 days. Thirty-day readmission rate reductions from 13.4% to 11.7% were not significant. After adjustment for patient characteristics, the adjusted 1-year readmission rate was significantly reduced by 15.6% and readmission LOS was significantly shorter by 1.7 days.[25]

In addition to the clinical and system improvements noted earlier, a cost-effectiveness economic evaluation demonstrated that health system savings amounted to more than 2 million dollars after factoring project implementation costs and a net savings of $1768/patient CAD.[26-28] The ERAS initiative was the signature project that enabled the launch of the benefits realization approach at AHS. The benefits realization approach enables innovation teams to demonstrate to health care funders and decision makers that their proposed solution has the potential to make the organization (or broader health system) measurably better and that the investment required for their proposed solution is likely to be worth it in relation to the value of the improvement that they expect to create.[29] Using the benefits realization approach, site-specific improvement forecasts were prepared for the initiative, and actual improvement results were monitored to demonstrate that value was being created, as planned (Figure 3).

The scale of the ERAS implementation across the province would not have been possible without an integrated LHS and the availability of local data that provided meaningful contextualized knowledge contributing to the compelling case for implementation as well as demonstrating value for the system through evaluation. The SCNs provided essential social capital and scientific infrastructure pillars of an LHS. The dedicated funding and the Innovation Pipeline's clear pathway provided essential policy and scientific accelerators to advance the initiative.

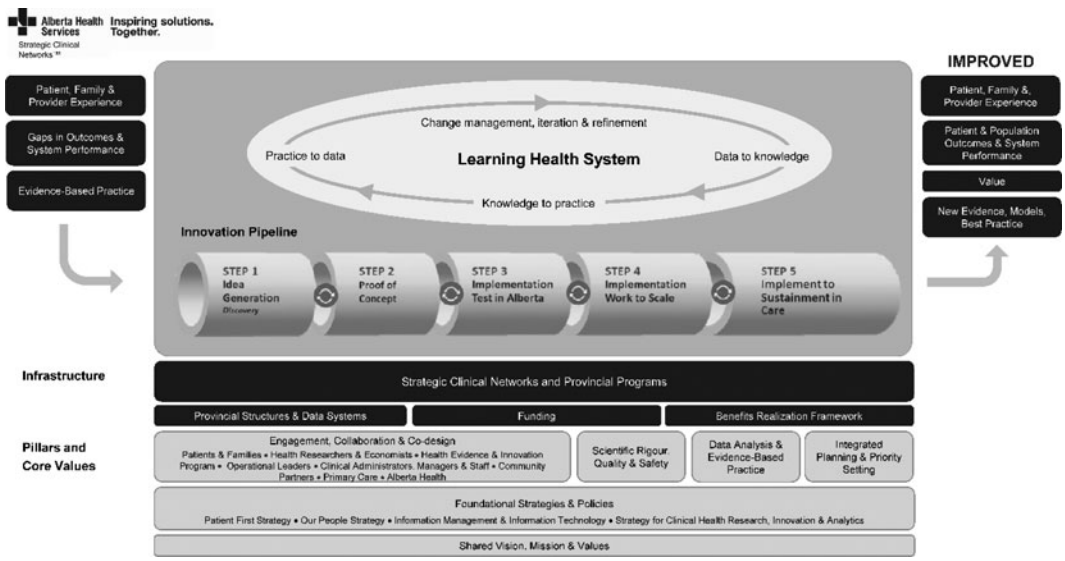

Figure 2. Interface between the AHS Innovation Pipeline, learning health system framework, and AHS Strategic Clinical Networks. AHS indicates Alberta Health Services.

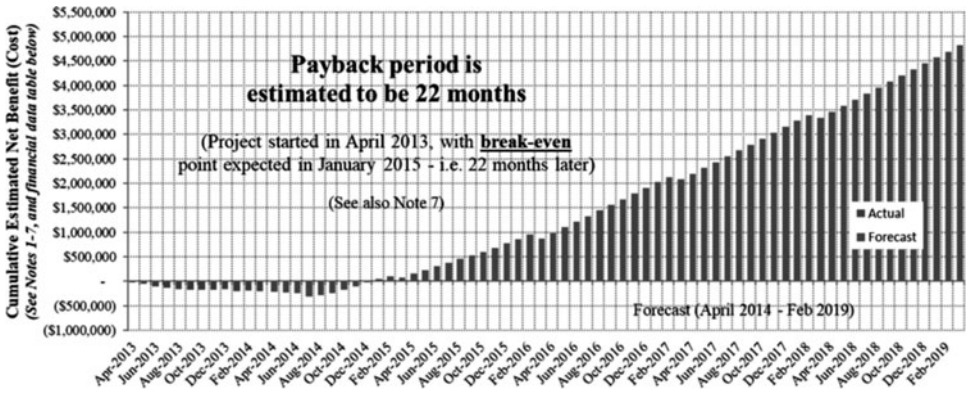

Figure 3. Enhanced Recovery After Surgery forecast and actual cumulative net value created.

ALBERTA FAMILY INTEGRATED CARE

Each year, 1 in 10 infants are born preterm.[30] Globally, that means 15 million infants and this number is increasing.[31] With increasing preterm births, neonatal intensive care units (NICUs) do not have enough beds or staff to meet this demand, with an unintended consequence of exceeding hospital budgets. Alberta FICare is the next generation of family-centered care for NICUs that provide care for critically ill and preterm newborns.[32] Prior to implementing a PRIHS-funded cluster randomized controlled trial (cRCT), we interviewed health care providers and hospital administrators who told us that the health care system was provider versus family focused and created challenges for the delivery of family-centered care.[33] Challenges such as uneven staffing, delays in implementing new policies, conflict in multidisciplinary teams, and mitigating the impact of semi-rural location interfered with providing quality family-centered care. Health care provider and hospital administrators' recommendations to improve care in level II NICUs included enhanced professional development, tools to deliver consistent care, continuity of care, recognizing parental capacity to be involved in care, and support for families to participate in care.

Alberta FICare is a health system quality improvement model that supports nurses and doctors to integrate parents into the NICU health care team.[32] Alberta FICare training has 3 components: relational communication, parent education, and parent support.[32] With practical tools and strategies, including interactive eLearning modules, neonatal care providers' roles broaden with a focus on educating and supporting parents as they gain knowledge, skills, and confidence in care of their baby. Results of the cRCT showed that with Alberta FICare, mothers[32] and fathers[34] were less stressed and more confident when their infant was ready for discharge. Infants in the Alberta FICare group had a shorter duration of parenteral nutrition and shorter time to full enteral feeding than infants in the standard care group.[35] Infants in the Alberta FICare group were discharged 2.5 days sooner and did not have more emergency department (ED) visits or readmissions than infants in the standard care group.[32] With earlier discharge, families avoided out-of-pocket costs for parking and food (unpublished data). AHS avoided NICU costs due to earlier discharge. At follow-up to 24 months' corrected age, infants in the Alberta FICare group had lower risk of communication delay than infants in the standard care group.[36] With positive results from the cRCT (last participant recruited July 28, 2018), the Alberta FICare team was invited in September 2018 to apply for and was successful in receiving funding from HIIS to scale and spread the innovation.

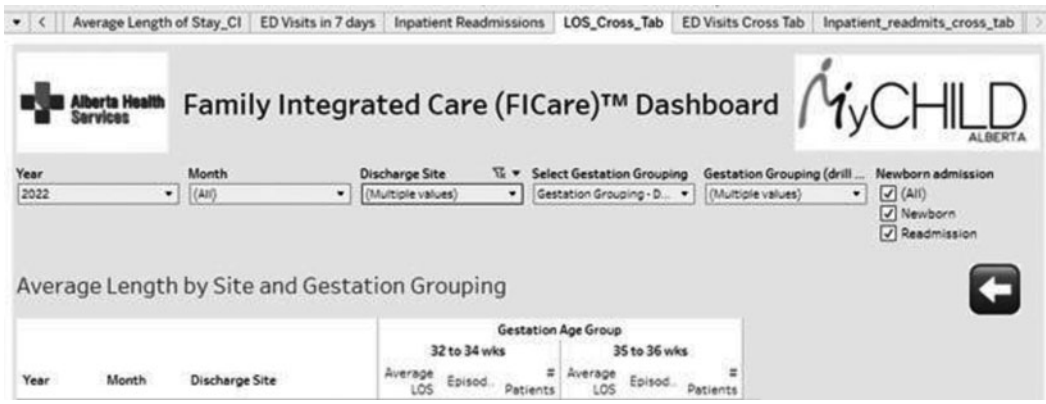

Figure 4. Screenshot of the Alberta Family Integrated Care Tableau dashboard. Health system data from this dashboard are imported into the Improvement Calculator. ED indicates emergency department.

With the Innovation Pipeline's predictable structures and processes,[11] the timeline from evidence to commencement of scale and spread was approximately 9 months. Alberta FICare was scaled and spread to all 14 NICUs across the province during the COVID-19 pandemic. Successfully scaling and spreading a new initiative during the pandemic were possible, in part, because of credibility of the core team to deliver on training and implementation and previous relationships (ie, with administrators, SCNs, clinicians, and researchers) built during the cRCT.[32]

With support of AHS Analytics and the core project team, Alberta FICare has a Tableau dashboard (Figure 4) with near real-time administrative data to continue monitoring key outcomes (LOS, ED visits, and readmissions). Building on experience with the ERAS initiative, the core project team consulted with the AHS Benefits Realization team to develop an Improvement Calculator to measure the value created from Alberta FICare, with a view to assess the ROI of the initiative. The Improvement Calculator compares current LOS data for each of the NICUs, taken from the project's Tableau dashboard, to expected LOS, estimated by the site's performance prior to the implementation of Alberta FICare to estimate the reduction in the number of NICU patient-days at each site, and then attaches a financial value to that improvement based on the inflation-adjusted average daily cost[37] in a Canadian NICU for infants with a gestational age of between 32 and 36 weeks. The Improvement Calculator shows that the initiative has realized a positive ROI, already creating $1.16 million in value for the Alberta health system by freeing up costly NICU capacity through LOS reductions (Figure 5). To demonstrate that the intervention did not adversely impact quality, the Improvement Calculator also incorporates balancing measures (7-day ED visits and 7-day readmissions) and similarly compares them to expected levels based on pre-project performance (Figure 6). As the initiative transitions from scale and spread to sustainment, the impact estimates and ROI calculations generated by the Improvement Calculator will support a business case for ongoing operational funding using near real-time data. Typically, health care decision makers must choose between quality and cost. With Alberta FICare, AHS receives higher-quality care at a lower cost.

Based on the successful application of the benefits realization approach for the ERAS and Alberta FICare initiatives, AHS and other funders (such as Alberta Innovates) now require that innovation teams prepare improvement forecasts to provide evidence that their initiatives have the potential to create measurable value for Alberta's health system.

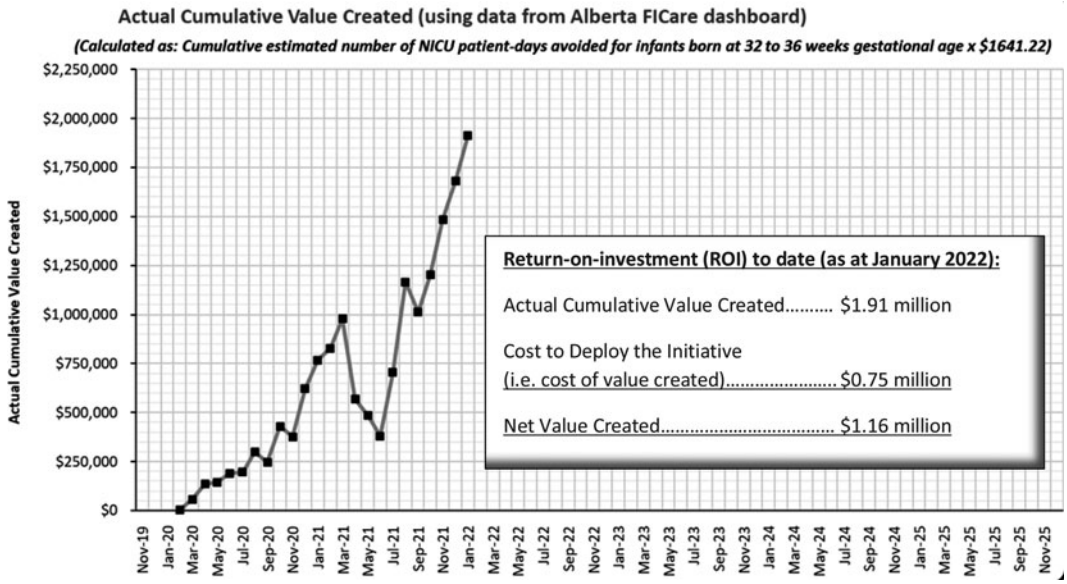

Figure 5. Alberta FICare cumulative value created based on the Improvement Calculator. Alberta FICare indicates Alberta Family Integrated Care.

IMPLICATIONS FOR NURSING LEADERS/CALL TO ACTION

Introducing innovations into the health system is challenging. Moving evidence into practice is a goal of health systems to optimize care, teamwork, and overall achievement of the Quadruple Aim.[5] Furthermore, while many projects can have initial success advancing the work beyond the testing phase, implementation at scale requires tools and resources to guide leaders in improving the Quadruple Aim. The Innovation Pipeline[11] is one approach that LHSs[7] can utilize to achieve VBHC decision-making.[1] It allows innovations to be tested and rigorously

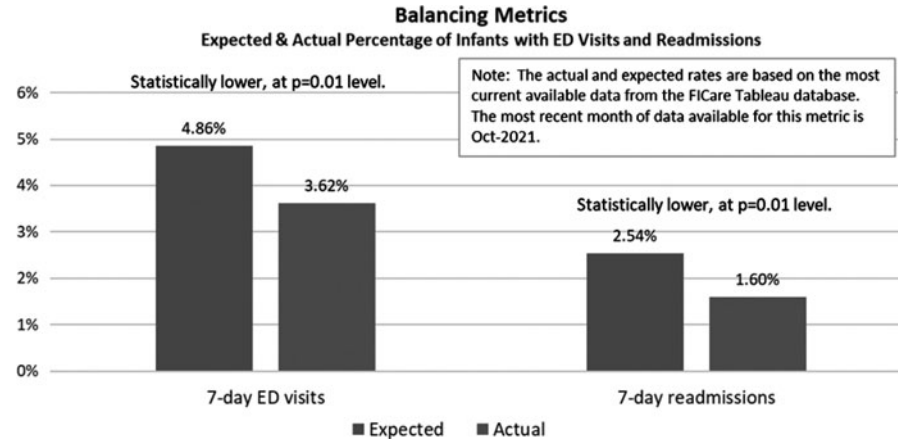

Figure 6. Alberta FICare balancing metrics for ED visits and readmissions. Alberta FICare indicates Alberta Family Integrated Care; ED, emergency department.

evaluated, generating evidence for decision makers to determine the best value for the clients they serve and at what cost.

Major elements of an LHS[7] to support this work require strong leadership, infrastructure, and system organization to learn at every level of scale, from a single clinician's practice to a hospital unit or an entire provincial system.[38] The Innovation Pipeline[11] is a strategic process allowing for early-stage projects to fail fast and for those that succeed to spread and scale faster. The Innovation Pipeline[11] embeds the essential elements of an LHS[7] so that understanding the mechanisms for advancing interventions that achieve the Quadruple Aim[5] can help organizations make better value-based decisions and improve evidence-based care. As illustrated in the 2 cases described, the essential building blocks included a robust iterative process for introducing change (Innovation Pipeline); measurement plans and data, including tools for sharing results and key outcomes to inform value-based decisions/investments (Benefits Realization framework and Improvement Calculator); supports for behavior and culture change (project resources and research funding); collaborative partnerships/networks to address priority topics (Maternal Newborn Child and Youth, Diabetes Obesity and Nutrition, and Surgery SCNs); and stakeholder involvement to achieve effective codesign of interventions. To make it easier for decision makers to make informed decisions, a clear path to testing and generating evidence is required. Mechanisms like the benefits realization process allow managers and decision makers to monitor progress in near real-time, ensuring the improvements not only are achieved but can also be maintained. The Improvement Calculator allows managers to better understand the performance of the system and attribute value to the improvement from a broad ROI perspective that includes values of the organization. These tools take advantage of the data available within the system and customize these to make them useable for frontline managers and decision makers demonstrating the practice to data to knowledge to practice LHS processes.

A key partnership within an LHS[7] is to link clinician expertise with the research community to ensure important questions can be answered in a rigorous manner to inform funding decisions and sustainability. These partnerships allow for mutually beneficial opportunities to advance evidence-based innovations of relevance[14]; while studying implementation fidelity to guide future implementation practices in context to the clinical environments that the testing is associated with.

To advance LHSs,[7] organizations need to provide some innovation funding or partnered funding to help advance innovations of value. Targeted funding to study effectiveness of interventions including implementation not only strengthens relationships with health system partners but also supports building capacity and capabilities to better inform impact, both clinically and from a research investment perspective.

CONCLUSION

Moving innovation into practice requires health systems to think about how their assets can be best organized as an LHS[7] to advance their ability to improve value-based decisions that improve the Quadruple Aim.[5] To shape this shift in thinking, leadership, infrastructure, and deliberate mechanisms, like an Innovation Pipeline[11] and strong networks of practice and research, can facilitate this change.[12]

REFERENCES

1. Teisberg E, Wallace S, O'Hara S. Defining and implementing value-based health care: a strategic framework. *Acad Med*. 2020;95(5):682-685. doi:10.1097/ACM.0000000000003122.
2. Canadian Foundation for Healthcare Improvement. *Accelerating Healthcare Improvement: CFHI Assessment Tool*™. Ottawa, ON, Canada: Canadian Foundation for Healthcare Improvement; 2014.
3. Lee MA. COVID pandemic as an incubator for a renewed vision of pediatric value-based healthcare. *Curr Probl Pediatr Adolesc Health Care*. 2021; 51(8):101064. doi:10.1016/j.cppeds.2021.101064.
4. Porter ME. What is value in health care? *N Engl J Med*. 2010;363(26):2477-2481. doi:10.1056/NEJMp1011024.
5. Valaitis RK, Wong ST, MacDonald M, et al. Addressing quadruple aims through primary care and public health: ten Canadian case studies. *BMC Public Health*. 2020;20(1):507. doi:10.1186/s12889-020-08610-y.
6. Marchildon GP, Allin S, Merkur S. *Health Systems in Transitions: Canada*. 3rd ed. Toronto, ON, Canada: University of Toronto Press; 2021.
7. Menear M, Banchette MA, Demers-Payette O, Roy D. A framework for value-creating learning health systems. *Health Res Policy Syst*. 2019;17(1):79. doi:10.1186/s12961-019-0477-3.
8. Noseworthy T, Wasylak T, O'Neill B. Strategic clinical networks in Alberta: structures, processes and outcomes. *Healthc Manage Forum*. 2015;28(6):262-264. doi:10.1177/0840470415600130.
9. Alberta Health Services. *Strategic Clinical Networks: Inspiring Solutions. Together*. https://www.albertahealthservices.ca/scns/scn.aspx. Accessed April 29, 2022.
10. Yui V, Belanger F, Todd K. Alberta's Strategic Clinical Networks: enabling health system innovation and improvement. *Can Med Assoc J*. 2019;191(suppl):S1-S3. doi:10.1503/cmaj.191232.
11. Waye A, Hughes B, Mrklas K, Fraser N. Innovation Pipeline: Intent to Scale for Impact. Primer 2.0. https://www.albertahealthservices.ca/assets/about/scn/ahs-scn-so-innov-pipeline-primer.pdf. Published 2021. Accessed April 29, 2022.
12. Wasylak T, Strilchuk A, Manns B. Strategic Clinical Networks: from pilot to practice change to planning for the future. *Can Med Assoc J*. 2019;191(suppl): S54-S56. doi:10.1503/cmaj.191362.
13. Greenhalgh T, Papousti C. Spreading and scaling up innovation and improvement. *BMJ*. 2019;365:l2068. doi:10.1136/bmj.l2068.
14. McNeil DA, Benzies KM, Zanoni P, Kurilova J. Alberta Family Integrated Care (FICare): from engaged clinicians in a cluster randomized controlled trial to health system partnerships in scale and spread across a province. In: McCutcheon C, Reszel J, Kothari A, Graham ID, eds. *How We Work Together: The Integrated Knowledge Translation Research Network Casebook*. Integrated Knowledge Translation Research Network; 2021.
15. Alberta Innovates. *Partnership for Research and Innovation in the Health System (PRIHS)*. https://albertainnovates.ca/programs/partnership-for-research-and-innovation-in-the-health-system-prihs/. Accessed April 29, 2022.
16. Alberta Health Services. Health System Research and Innovation: Strategic Clinical Networks™. https://www.albertahealthservices.ca/scns/Page13668.aspx#:~:text=HIIS%20funding%20supports%20provincial%20implementation,research%20projects%20or%20pilot%20studies. Published 2022. Accessed May 30, 2022.
17. Balas EA, Boren SA. Managing clinical knowledge for health care improvement. *Yearbook of Med Inform*. 2000;(1):65-70. doi:10.1055/s-0038-1637943.
18. Simpson JC, Moonsinghe SR, Grocott MPW, et al. Enhanced recovery from surgery in the UK: an audit of the enhanced recovery partnership program 2009-2012. *Br J Anaesth*. 2015;115(4):560-568. doi:10.1093/bja/aev105.
19. Gillissen F, Hoff C, Maessen JMC, et al. Structured synchronous implementation of an enhanced recovery program in elective colonic surgery in 33 hospitals in the Netherlands. *World J Surg*. 2013;37(5):1082-1093. doi:10.1007/s00268-013-1938-4.
20. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: a review. *JAMA Surg*. 2017;152(3): 292-298. doi:10.1001/jamasurg.2016.4952.
21. Gramlich LM, Sheppard CE, Wasylak T, et al. Implementation of Enhanced Recovery After Surgery: a strategy to transform surgical care across a health system. *Implement Sci*. 2017;12(1):67. doi:10.1186/s13012-017-0597-5.
22. Fearon KCH, Ljungqvist O, Von Meyenfeldt M, et al. Enhanced Recovery After Surgery: a consensus review of clinical care for patients undergoing colonic resection. *Clin Nutr*. 2005;24(3):466-477. doi:10.1016/j.clnu.2005.02.002.
23. Greco M, Capretti G, Beretta L, Gemma M, Pecorelli N, Braga M. Enhanced recovery program in colorectal surgery: a meta-analysis of randomized controlled trials. *World J Surg*. 2014;38(6):1531-1541. doi:10.1007/s00268-013-2416-8.
24. Adamina M, Kehlet H, Tomlinson GA, Senagore AJ, Delaney CP. Enhanced recovery pathways optimize health outcomes and resource utilization: a meta-analysis of randomized controlled trials in colorectal surgery. *Surgery*. 2011;149(6):830-840. doi:10.1016/j.surg.2010.11.003.
25. Nelson G, Wang X, Nelson A, et al. Evaluation of the implementation of multiple Enhanced Recovery

After Surgery pathways across a provincial health care system in Alberta, Canada. *JAMA Netw Open*. 2021;4(8):e2119769. doi:10.1001/jamanetworkopen.2021.19769.

26. Bisch SP, Wells T, Gramlich L, et al. Enhanced Recovery After Surgery (ERAS) in gynecologic oncology: system-wide implementation and audit leads to improved value and patient outcomes. *Gynecol Oncol*. 2018;151(1):117-123. doi:10.1016/j.ygyno.2018.08.007.
27. Nelson G, Kiyang LN, Crumley ET, et al. Implementation of Enhanced Recovery After Surgery (ERAS) across a provincial healthcare system: the ERAS Alberta colorectal surgery experience. *World J Surg*. 2016;40(5):1092-1103. doi:10.1007/s00268-016-3472-7.
28. Thanh NX, Chuck AW, Wasylak T, et al. An economic evaluation of the Enhanced Recovery After Surgery (ERAS) multisite implementation program for colorectal surgery in Alberta. *Can J Surg*. 2016;59(6):415-421. doi:10.1503/cjs.006716.
29. Wasylak T, Osiowy K, Anderson C. Enhanced Recovery After Surgery—making the business case: economics—the Alberta experience. In: Ljungqvist O, Francis NK, Urman R, eds. *Enhanced Recovery After Surgery A Complete Guide to Optimizing Outcomes*. Berlin, Germany: Springer Nature; 2020:599-607.
30. Chawanpaiboon S, Vogel JP, Moller A-B, et al. Global, regional, and national estimates of levels of preterm birth in 2014: a systematic review and modelling analysis. *Lancet Global Health*. 2019;7(1):e37-e46. doi:10.1016/S2214-109X(18)30451-0.
31. Vogel JP, Chawanpaiboon S, Moller A-B, Watananirun K, Bonet M, Lumbiganon P. The global epidemiology of preterm birth. *Best Pract Res Clin Obstet Gynecol*. 2018;52:3-12. doi:10.1016/j.bpobgyn.2018.04.003.
32. Benzies KM, Aziz K, Shah V, et al. Effectiveness of Alberta Family Integrated Care on infant length of stay in level II neonatal intensive care units: a cluster randomized controlled trial. *BMC Pediatrics*. 2020;20(1):535. doi:10.1186/s12887-020-02438-6.
33. Benzies KM, Shah V, Aziz K, Lodha A, Misfeldt R. The health care system is making "too much noise" to provide family-centred care in neonatal intensive care units: perspectives of health care providers and hospital administrators. *Intensive Crit Care Nurs*. 2019;50:44-53. doi:10.1016/j.iccn.2018.05.001.
34. Shafey A, Shah V, Benzies K. Fathers' experiences in Alberta Family Integrated Care: a qualitative study. *J Perinat Neonatal Nurs*. In press.
35. Murphy M, Shah V, Benzies K. Effectiveness of Alberta Family Integrated Care on neonatal outcomes: a cluster randomized controlled trial. *J Clin Med*. 2021;10(24):5871. doi:10.3390/jcm10245871.
36. Moe AM, Kurilova J, Afzal AR, Benzies KM. Effects of Alberta Family Integrated Care (FICare) on preterm infant development: two studies at 2 months and between 6 and 24 months corrected age. *J Clin Med*. 2022;11(6):1684. doi:10.3390/jcm11061684.
37. Rios JD, Shah PS, Beltempo M, et al. Costs of neonatal intensive care for Canadian infants with preterm birth. *J Pediatr*. 2021;229:161-167.e12. doi:10.1016/j.jpeds.2020.09.045.
38. Noseworthy T. Innovation in the Canadian health system. *Healthc Manage Forum*. 2021;34(1):5-8. doi:10.1177/0840470420936709.