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Mobilizing strategic inflection points for sustainment of an effective intervention in an integrated learning health system: an interpretive description

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Abstract

Background Innovative models of care have the potential to improve the sustainability of health systems by improving patient and provider experiences and population outcomes while simultaneously reducing costs. Yet, it is challenging to recognize the distinctive points during research and quality improvement processes that contribute to sustainment of effective interventions. The business concept of an inflection point—the position on the curve of a trajectory where the progress in implementation of an intervention is accelerated or decelerated—may be useful to understand implementation and improve sustainability and ultimately sustainment of effective interventions. The purpose of this study was to retrospectively identify and describe strategic inflection points that accelerated the sustainability process and led to the sustainment of Alberta Family Integrated Care.

Methods This qualitative study was conducted in Alberta, Canada and employed an interpretive description design. Purposively sampled documents (proposals, project management plans, reports to funders and sponsors, meeting minutes, and fidelity audit and feedback checklists) from the Alberta Family Integrated Care cluster randomized controlled trial and quality improvement project constituted data for this study.

Results To accelerate sustainability in the research context, we identified (1) alignment with strategic priorities, (2) iterative, user-centered co-design, and (3) contextualization of implementation as strategic inflection points. To accelerate sustainability in the health system context, we identified (1) the learning health system, (2) enduring partnerships, (3) responsivity to societal and system change, (4) embedded governance, and (5) intentional integration into the health system as strategic inflection points. Capitalizing on these strategic inflection points led to sustainment of Alberta Family Integrated Care in the provincial health system.

Conclusions We identified key inflection points in the research and health system contexts that led to sustainment of Alberta Family Integrated Care. By anticipating, recognizing, and leveraging inflection points in the sustainability process, researchers may be able to accelerate implementation and achieve sustainment of multi-component interventions in complex systems.

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Keywords Implementation science, Sustainability, Evidence-based practice, Sustainment, Quality improvement, Intervention, Knowledge mobilization, Family integrated care, Family centred care

Contributions to the literature

- Differentiates sustainability and sustainment in a healthcare intervention implementation.
- Identifies inflection points that accelerated sustainability, and ultimately sustainment, of a multi-component healthcare intervention.
- Based on inflection points, recommends strategies for design, evaluation, and implementation to achieve sustainment of multi-component interventions in complex systems.

Background

Healthcare spending has been growing more rapidly than inflation for decades and is at risk of jeopardizing other publicly funded services [1]. This problem was exacerbated by the COVID-19 pandemic, which increased healthcare spending [2–4], deferred non-urgent care [5], and exposed and worsened health inequities [6]. Innovative models of healthcare have the potential to sustain health systems by improving patient and provider experiences and population outcomes while simultaneously reducing costs [7]. Yet, it is challenging to recognize distinctive points in implementation processes that will contribute to sustainment of an effective intervention. The aim of this study was to describe qualitatively how we identified and mobilized strategic inflection points to facilitate sustainment of a multi-component intervention in an integrated learning health system (LHS). Like Shiell et al., [8] we consider complexity as a characteristic of the implementing LHS. Although there is limited literature about strategic inflection points in health systems, the concept is well-articulated in other fields including mathematics, all business (economic, finance), and geopolitical.

Derived from mathematical economics, an inflection point is a change in the curve direction as the result of an occurrence. More broadly, an inflection point refers to any event that transforms the trajectory of a company, industry, geopolitical situation, or economy that may lead to a positive or negative result and requires a fundamental change in strategy [9]. Inflection points and change trajectories vary by type of intervention and context; rarely can any single factor be attributed to change; they happen gradually and then suddenly, often taking leaders by surprise [9]. In the 1990s, Grove [10] published seminal work on strategic responses

to inflection points in business. Grove's perspective was how to respond to an inflection point after it had occurred [10]. For example, when a multinational bookstore moves into the same neighborhood as a small bookstore, that is a strategic inflection point that requires a fundamental change in the business model for the small book store owner. More recently, McGrath [9] took the perspective of creating innovation proficiency within an organization to anticipate an inflection point and respond nimbly to capture the advantage. For example, a carbonated beverage company that developed a new line of non-carbonated beverages would be considered to have anticipated the inflection point of evolving consumer preference.

In health systems, anticipating, recognizing, and strategically responding to inflection points may accelerate the trajectory of an effective intervention from proof of concept to scale and spread, and sustainment. The COVID-19 pandemic is an example of an inflection point that drove the direction and pace of healthcare interventions. Globally, the pandemic hastened research and implementation activities focused on prevention and treatment of infectious respiratory diseases, and digital health technologies, but decelerated or halted non-COVID related activities [11].

The global value-based health movement has been described as a critical inflection point with the potential to radically transform health systems within the next 10 years [12]. Several studies have quantified trajectories such as (1) identifying the downstream financial burden of a disease [13], (2) quantifying indicators of risk for future disease by age [14], (3) triggering action based on a disease trajectory [15] and (4) identifying readiness for discharge based on trajectories of patient length of stay costing [16]. Implementation of interventions and initiatives contributing to value-based health systems require identification of processes (inflection points) that substantively change the trajectory in a positive direction towards sustainment. Yet, there are few practical illustrations of successful operationalization of inflection points that have led to sustainment of an intervention or initiative.

Implementation is considered the process, or constellation of processes, of embedding an effective intervention into an organization either through research or quality improvement (QI) approaches [17–19]. If implementation is successful, it should result in changes at multiple levels in a system [20, 21]. Sustainment of

these changes requires that the intervention continues to be aligned with strategic priorities, with ongoing capacity to deliver with fidelity, and expected outcomes maintained [20]. If the final phase of implementation of an intervention is sustainment [22], then it should be considered early in implementation [23]. Yet, the duration of grants often limits evaluation of implementation outcomes [24, 25]. Thus, there is a lack of implementation science literature about how researchers should plan for and evaluate sustainability and sustainment.

Although empirically derived definitions of sustainability exist [26, 27], there is little consensus on application [28]. In a concept analysis of sustainability [27], only eight of the 19 included implementation models explicitly addressed sustainability or sustainment. Of these eight models, four viewed sustainability as separate from the implementation process and four viewed it as the final phase. In a systematic review of sustainability of new programs and services, only 29% of studies provided an operational definition [29]. This aligns with other studies that concluded the definitions and applications of the term sustainability are inconsistent and ambiguous [22, 26, 27] and vary by context [24]. In their concept analysis, Fleischer et al. [27] suggested that sustainability is the final phase in implementation. In their mixed methods study of the role of systems and leadership, Aarons et al. [30] used the terms sustainability and sustainment interchangeably. In a subsequent narrative review of measurement for sustainment [20], including Aarons, the authors defined sustainment as an outcome. Yet, in their qualitative study, Urquhart et al. [31] defined sustainability as an

outcome. To add to the confusion, in a systematic review, Shelton et al. [22] applied sustainability as a process and an outcome.

Until there is consensus on terminology, we define sustainability as part of the ongoing and dynamic process during implementation [28] with support of external change agents in research and health system contexts [32] that ensure maintenance of intervention function and form [33]. Function of a multi-component intervention is standardized with irreducible required components [34] that must be delivered with fidelity [33]. Form of the intervention is designed to adapt to the local site context without sacrificing fidelity to the function [33].

Similar to the [20] narrative review, we define sustainment as an outcome beyond initial implementation [29, 31] that ensures (1) the intervention is routinized in the system [20, 26] in the absence of the external change agent [31], (2) continued individual, organization, and financial capacity to deliver the intervention with fidelity [26, 31], and (3) continued production of benefits for individuals and systems [26, 31].

Characteristics of exemplar intervention: Alberta Family Integrated Care™

According to defined categories [35], we describe characteristics of the exemplar intervention, Alberta Family Integrated Care™ (FICare), and the implementing sites using indicators of evidence, usability, and supports, as well as need, fit, and capacity. See Fig. 1. Alberta FICare™ [36] is a model of family centered care for neonatal intensive care units (NICUs).

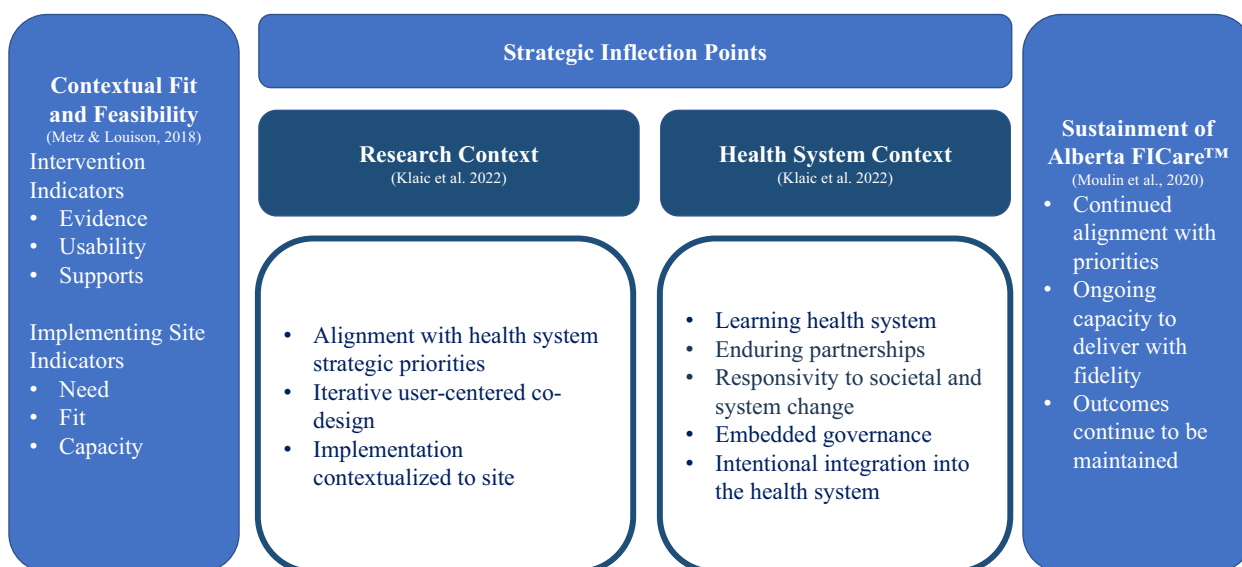


Fig. 1 Contextual fit and feasibility of Alberta FICare™, strategic inflection points in research and health system contexts that influenced sustainability, and sustainment of Alberta FICare™

In level III NICUs, there was equivocal evidence that family centered care interventions improved outcomes for critically ill and preterm newborns and their parents and caregivers [37, 38]. However, there was no difference between the level III NICU model of FICare and standard care groups in healthcare utilization [38]. Using a train-the-trainer model, flexibility in operationalization, and inattention to fidelity resulted in considerable variability in implementation and outcomes in level III NICUs. As with many intervention studies, when research funding ended, positive changes achieved during the international cluster randomized controlled trial (cRCT) eroded and the practice was not sustained. If efficacious, FICare had the potential to improve the quality of care and outcomes for level II NICUs, which is a strategic priority of Alberta Health Services (AHS), Maternal Newborn Child and Youth (MNCY), Strategic Clinical Network™ (SCN) [39]. Thus, there was emerging evidence, need, and fit for adaptation of the level III model for a cRCT in 10 level II NICUs [36].

In addition to grant funding, a strong partnership between University of Calgary researchers and AHS [40] created the capacity to evaluate Alberta FICare™. We undertook sequential evaluation in two contexts [32]: research context (cRCT [36, 41, 42] and qualitative studies [43–45]) and health system context (scale and spread QI project [46]). The cRCT demonstrated reductions in infant length of stay with no concomitant increases in emergency department (ED) visits or readmissions [36]. On the strength of these results, our team scaled and spread Alberta FICare™ with ongoing evaluation of key health system indicators (length of stay, ED visits, and readmissions) and benefits realized (cost avoidance) [46]. The AHS Innovation Pipeline [47] with its associated funding mechanisms reduced the latency period between the end of the cRCT and QI project to 9 months, which enabled us to repurpose and enhance knowledge, documentation, and processes.

Towards the end of the QI project, we reflected on our implementation processes and wondered if there were strategic inflection points that increased sustainability and the potential for sustainment of Alberta FICare™. The purpose of this study was to retrospectively identify and describe strategic inflection points in research and health system contexts [32] that influenced sustainability and sustainment. Our goal with this study was to address a gap in the literature by providing a deeper understanding of inflection points with an exemplar of successful operationalization of inflection points for sustainment of a multi-component intervention in a LHS.

Theoretical framework

In the field of sustainability and sustainment, there are two frequently used theories: Dynamic Sustainability Framework [48], and Exploration, Preparation, Implementation, and Sustainment (EPIS) framework [49]. In the Dynamic Sustainability Framework [48], the outcome is adaptation and optimization of an intervention for other populations and settings. While in the EPIS framework [49], the outcome is sustainment of the administration, funding, and evaluation of an intervention. Given the goal of the initiative was sustainment of Alberta FICare™ in NICUs, we applied the EPIS framework to explore how inflection points mapped onto sustainment of the initiative.

Methods

We used interpretive description [50, 51] to identify strategic inflection points because this qualitative method guides an organizing logic for practice decisions rather than prescribing a series of steps in a research process. To situate this study in the field [50], we brought clinical nursing experience in NICUs (KB and DM) and research experience with the Alberta FICare™ cRCT (KB and PZ) and QI project (KB, PZ, DM). The University of Calgary, Conjoint Health Research Ethics Board (ID 15–0067), University of Alberta, Health Research Ethics Board (Pro00060324), and Covenant Health, Health Research Ethics Board (ID 1762) provided ethical approval for the cRCT. The ethics board exempted the QI project and this study. To improve the quality and transparency of reporting, we applied the Standards for Reporting Implementation Studies [52].

Setting

We conducted the Alberta FICare™ cRCT and QI project in NICUs in Alberta, Canada, between December 2015 and June 2022. Alberta's population is typically younger, with higher income, and a greater proportion of individuals of reproductive age than the Canadian average [53]. AHS, together with its contractor Covenant Health, comprises the first and largest integrated learning healthcare organization in Canada, serving 4.262 million people in Alberta, as well as some residents of Saskatchewan, British Columbia, and the Northwest Territories [54]. Through standardization of many operations, AHS offers numerous advantages for rapid evaluation, scale, and spread, and adoption of value-based health system improvements [55, 56].

Concepting the data

Data sources for interpretive description can take many forms [50]. We purposively sampled documents from the cRCT and QI project (Table 1). From these documents,

Table 1 Data sources and rationale for strategic inflection points in research and health system contexts

Sustainability Context	Inflection Point	Data Source	Why an Inflection Point Contributed to Sustainment
Research	Alignment with health system strategic priorities	<ul style="list-style-type: none"> AHS MNCY SCN strategic priorities [39] cRCT proposal; QI project management plan 	<ul style="list-style-type: none"> Alignment with existing priorities facilitated support from health system for grant applications, communications, consultations, and access to resources
	Iterative user-centered co-design	<ul style="list-style-type: none"> Meeting minutes: initial training session; summaries of testing revised model at sites; parent advisory committees Feedback from healthcare providers Peer-reviewed publications 	<ul style="list-style-type: none"> Listening and responding to needs of end-users during the research phase reduced barriers to scale and spread of the intervention in the 'real world'
	Contextualized Implementation	<ul style="list-style-type: none"> Site baseline assessments Site fidelity audits and debrief meeting minutes 	<ul style="list-style-type: none"> Baseline assessments were used to identify site-specific barriers and facilitators to implementation. The form of the intervention was adapted to the local site context and delivered
Health System	Learning health system	<ul style="list-style-type: none"> Peer-reviewed publications Presentations to Alberta Innovates ABSORU Implementation Science in Patient Oriented Research Certificate Course 	<ul style="list-style-type: none"> Learning health system outcomes (patient/provider experiences, population health, and cost) focused research and quality improvement efforts on outcomes that were important to the health system
	Enduring partnerships	<ul style="list-style-type: none"> Peer-reviewed publications Project Team meeting minutes cRCT proposal; QI project management plan 	<ul style="list-style-type: none"> Enduring partnerships based on trust facilitated a rapid transition from research to scale and spread, and then to sustainment in the health system
	Responsivity to societal and health system change	<ul style="list-style-type: none"> LGBTQS + content added to training modules Clinical Nurse Educator committee transferred parent education pathway content to new electronic medical record 	<ul style="list-style-type: none"> Required annual updates facilitated incorporation of new information relevant to evolving societal norms and new technology
	Embedded governance	<ul style="list-style-type: none"> Governance structure Executive Sponsor and Provincial Steering Committees meeting minutes Consultations with sponsors 	<ul style="list-style-type: none"> Embedding the governance structure for oversight of the initiative ensured visibility, regular updates, and rapid solutions to emerging issues
	Intentionally integrating into the system	<ul style="list-style-type: none"> Alberta FICare™ training modules, tools, and resources easily accessible on AHS and MNCY SCN websites AHS Sustainability Program Office providing ongoing monitoring of capacity to deliver and outcomes 	<ul style="list-style-type: none"> Integration into the health system created a sense of ownership of Alberta FICare™ with operational support and financial commitment to sustainment of the initiative

AHS Alberta Health Services, MNCY SCN Maternal Newborn Child and Youth, Strategic Clinical Network, ABSORU Alberta Strategy for Patient Oriented Research Unit

which were created and used by the Alberta FiCare™ Project Team (hereafter referred to as Project Team) to guide day-to-day operations, we identified key information to signal inflection points for sustainability, and ultimately sustainment, of Alberta FiCare™. Application of project management principles ensured data sources were high quality. The project management plan and monthly and annual reporting documents met standards for reporting to the sponsors. Meeting minutes were created systematically following each encounter at multiple levels in the health system. Fidelity audits employed a standardized checklist and we verified accuracy during debrief meetings with the Local Site Implementation Teams, comprised of a manager from nursing and allied health, medical director, clinical nurse educators, front-line nurses and allied health staff, and parent advisors, at each NICU [57]. Version control of documents enhanced accuracy of timelines in determining the influence of each inflection point on sustainability.

Transforming the data

Data sources were systematically organized by type of document. Then, the Project Team began tracking concepts and searching for patterns of concepts in the data. We were mindful of structures, processes, and connections that facilitated implementation and reinforced opportunities for sustainment. We considered inflection points that recurred across multiple data sources. Aligned with Thorne [50], we avoided using a rigid coding tree and chose instead to ask repeatedly, “What is happening here?” and “Why does that happen here?” This approach enabled exploration and labeling of emerging patterns and allowed us to expand and collapse concepts and organize them in a way that may be most meaningful to other implementation scientists. Given the Project Team’s deep and extended experience with Alberta FiCare™, our approach to transforming the data was intrinsically experiential and extended beyond what any one individual may experience in their purview. The final step in envisioning inflection points was to determine which played a fundamental role in understanding of and application for sustainability of a multi-component intervention in a complex system.

Considerations for rigor

In this work, we attended to epistemological integrity [50, 58] by following a logical interpretive process from research question to decisions about labels for inflection points that emerged from the data. Representative credibility of the findings was reinforced by returning to the literature and consulting with experts in business and implementation science. Our analytic logic was categorized by the processes that we believed influenced

sustainability. Documents revealed patterns of inflection points within two contexts already identified in the literature: research and healthcare [32]. Trustworthiness of interpretation resulted from the experience and extended exposure of the Project Team to the data. These considerations of rigor contributed to transforming the data to generate meaning and potential for application of our research findings to the field of implementation science.

Findings

In alignment with interpretive description [50], we applied the idea of inflection points and conceptualized them within research and health system contexts from the perspective of researchers. See Fig. 1.

Sustainability in the research context: inflection points

Alignment with health system strategic priorities

Alberta FiCare™ capitalized on alignment with MNCY SCN™ strategic priorities and University of Calgary researchers were supported to apply for an Alberta Innovates, Partnership for Research and Innovation in the Health System grant for the cRCT [39]. With positive results, MNCY SCN™ partnered as a primary knowledge user on a Health Innovation Implementation and Spread grant for the QI project [40]. During the cRCT and QI project, MNCY SCN™ facilitated connections, consultations, and access to complementary health system resources. Thus, we interpreted that alignment of Alberta FiCare with continuing MNCY SCN strategic priorities from the cRCT to QI project and beyond was an inflection point in sustainability processes and contributed to sustainment.

Iterative user-centered co-design

In the development of Alberta FiCare™, we employed iterative, user-centered co-design [59] to adapt components and implementation processes. Adaption was required because healthcare providers (HCP) in Alberta level II NICUs expressed concerns about the feasibility of operationalizing the level III NICU FiCare model [60]. Parents of preterm infants were involved throughout the design and reinforced the importance of the new relational communication component. We further standardized implementation processes during the QI project to make staff training accessible via eLearning modules, which contain real-world parent scenarios and HCP testimonials. The adapted eLearning modules were pilot tested, refined, and uploaded to the health system’s learning management systems. Upon request by HCP, and with advice of parent advisory committees and approval of the MNCY SCN™ NICU Standing Committee [61], we added practical tools (e.g., videos, questioning cue cards, tip sheets) to support adoption of Alberta FiCare™ into

daily practice. Co-design of the Alberta FICare™ model was possible due to the Project Team's deep understanding of function and form of the model, as well as implementation context [62]. In response to physician stakeholders communicating the importance of accredited continuing professional development, the Royal College of Physicians and Surgeons of Canada accredited Alberta FICare™ training. Thus, we interpreted that listening and responding to the implementation needs of users early in the research and throughout both the research and scale and spread reduced barriers to real world implementation was an inflection point that contributed to sustainability and ability of Alberta FICare™ to be operationalized in the system with ongoing capacity to deliver it with fidelity.

Implementation contextualized to site

Prior to the cRCT, we conducted interviews with HCP and hospital administrators in level II NICUs to understand and address barriers and facilitators to implementation of family centered care [63]. Prior to the QI project, we employed an implementation science framework [18] to identify external, system, unit, and individual facilitators and barriers for implementation of Alberta FICare™ [44]. Before implementation in the QI project, we adapted the Hexagon Tool by the National Implementation Research Network [35] to develop a baseline assessment of context at the unit and hospital level. This practical tool acknowledges that context directly influences implementation outcomes and success and was used to inform tailored site implementation approaches to enhance effectiveness and implementation locally. Thus, by using implementation frameworks to systematically identify and remove site specific barriers and enhance facilitators, we interpreted site contextualization as a key inflection point contributing to the capacity to deliver the intervention with fidelity.

Sustainability in the health system context: inflection points

Learning health system

Alberta FICare™ was implemented in a LHS, which aims to improve the value of health systems [7, 64]. Value is the measured improvement in patient and health system outcomes for the cost of achieving that improvement [64, 65]. In an LHS, change is enabled through strategically designed organization, policies, and funding to accelerate knowledge to practice cycles. In Alberta, SCNs™ are the vehicles to operationalize the LHS [56, 66]. In existence since 2012, SCNs™ were built on multidisciplinary partnerships, including patients, families, and the public, designed to identify gaps in health care and move evidence into practice via an Innovation Pipeline

[47]. Within the existing structures and processes of the LHS, the Project Team was supported by, then partnered with, the MNCY SCN™ to apply for sequenced, competitive funding that enhanced sustainability and resulted in sustainment of Alberta FICare™. Within these defined structures and processes, we moved from the end of the cRCT to the QI project in nine months. Typically, it takes 17 to 21 years to move research into practice [67–70]. To ensure outcomes were maintained, we co-designed an Alberta FICare™ dashboard to support near real-time measurement linking implementation progress to key indicators [66]. We also co-developed a prototype improvement calculator that uses data from the dashboard to enable comparison of actual and forecasted value [46]. These tools were foundational to the financial accountability of Alberta FICare™. Without a value-based LHS [7], it is unlikely the Project Team would have approached sustainability in the same way. Thus, we interpreted that an LHS was an inflection point, ensuring there was an ongoing capacity to deliver Alberta FICare™ with fidelity and maintain expected outcomes.

Enduring partnerships

Throughout the cRCT, we developed partnerships with key academic, operational, clinical and community stakeholders. These relationships emerged as an inflection point in a publication [40], meeting minutes, and change management processes. Across the cRCT and QI project, these partnerships endured with the MNCY SCN™ facilitating consultations with AHS operational leaders about implementation approaches to facilitate sustainment of Alberta FICare™. The critical nature and complementary roles in this partnership became more evident during the pandemic. For example, during COVID-19 pauses when the health system was inaccessible, academic Project Team members continued working on implementation activities while AHS members were redeployed for COVID-related work. At the conclusion of the QI project, these enduring partnerships facilitated the transition to sustainment by assisting to navigate a complex series of budget approval processes that resulted in operational funding for two positions within MNCY SCN™ (Alberta FICare™ Practice Lead and Family Mentor Clinical Coordinator) to maintain fidelity and ongoing evaluation of outcomes. Thus, we interpreted enduring partnerships as an inflection point to achieve sustainment, as demonstrated by adoption in the system and ongoing capacity to deliver Alberta FICare™ with fidelity and maintain outcomes.

Responsivity to societal and system change

Given the pace of change in society and health systems, it was important for the Project Team to respond

without compromising the integrity of the functions of Alberta FICare™. We reviewed content in the eLearning modules annually and updated as social norms changed and new evidence became available, such as emerging research on the experiences of LGBTQ2S+ parents in the NICU. We embedded eLearning modules into orientation for nurses new to the NICU. During the QI project, launch of a provincial electronic medical record eliminated the need for the paper Parent Education Pathway, a tool staff used to standardize and sequence evidence-informed parent education. To ensure the Parent Education Pathway concept and content was retained, we established a provincial working group to optimize the Parent Education module in the new electronic medical record. The QI project transitioned the responsibility to complete this optimization to the Alberta FICare™ Practice Lead. Thus, we interpreted that the ability to adapt to societal and health system change was an inflection point that contributed to sustainment.

Embedded governance

With relationships established during the cRCT, we had a strong foundation upon which to build the governance structure required to scale and spread, and subsequently sustain Alberta FICare™. MNCY SCN™ supported Alberta FICare™, first as a strategic advisor and knowledge user in the cRCT, then as full implementation partner in the QI project [40]. During the QI project, an Executive Sponsor Committee comprising Senior Operating Officers and Medical Leads ensured there was senior-level oversight. A Provincial Steering Committee included parent advisors, operational leads, medical leads, and frontline clinicians to support, inform, and help drive implementation. MNCY SCN™ acted as liaison between the Project Team and higher levels in the structure. As the main point of contact for the Project Team, Local Site Implementation Teams generated awareness of and fostered engagement with Alberta FICare™ implementation on their units, received quarterly fidelity reports, monitored, and responded to implementation challenges locally, prioritized and advanced the next steps, and reported issues and risks to the Project Team. The governance structure ensured that (1) the initiative remained visible, (2) sponsors and champions received regular updates and offered advice at key decision points, and (3) any issues could be escalated quickly for a solution. Thus, we interpreted that embedding the governance structure within the existing health system was a key inflection point that contributed to routinization and the ability to continue to measure outcomes.

Intentional integration into the health system

Fidelity audits, feedback, and integrating Alberta FICare™ training into orientation for new hires contributed to routinizing the intervention. Alberta FICare™ tools are hosted on internal and external websites (ahs.ca/albertaficare) for staff and parents. Parent resources are now integrated in existing provincial online health resource websites (e.g., Healthy Parents Healthy Children [30], MyHealth Alberta [71]).

Over the final year of the QI project, the Project Team sought advice from the Provincial Steering Committee, Local Site Implementation Teams, and frontline staff about requirements for sustainment. These recommendations included a business case to AHS for ongoing operational funding to support sustainability. At this level, funding requests are first reviewed by a clinical operations executive committee accountable to (1) guide the delivery of safe and quality clinical care and service provincially, deciding on strategic and operational matters related to clinical operations, (2) develop, review, support, and approve evidence-informed decisions related to clinical operations, and (3) provide alignment and coordinating function for clinical operations planning and for implementing initiatives. With feedback and endorsement from this committee, a refined business case was presented to the Budget Executive Leadership Team, which approved the request 6 weeks following the conclusion of the QI project. This process resulted in ongoing sponsorship and accountability to the MNCY SCN™ NICU Standing Committee [61], and two new positions administered by the MNCY SCN™, as recommended by clinical and operational stakeholders. These positions will establish the peer family mentorship component that was incompletely operationalized due to COVID, support capacity for ongoing delivery of the intervention, and continue to maintain fidelity to the function and form of the intervention. As a condition of ongoing financial support, the MNCY SCN™ will continue to evaluate Alberta FICare™ using indicators important to AHS. With the success of Alberta FICare™ from idea to ongoing funding, there is a process and precedent for similar evidence-informed health interventions to be quickly and efficiently adopted into practice. Thus, we interpreted our intentional strategies to integrate the training, monitoring, and oversight into the health system as an inflection point.

Discussion

In this qualitative, interpretive description study [50], we purposively sampled documents from implementation of a cRCT [36] and scale and spread [46] of Alberta FICare™ projects to identify strategic inflection points

that contributed to sustainability, and ultimately sustainment, of an effective, multi-component intervention in a complex LHS. This research is novel because we applied a business concept, inflection points [9], to increase understanding and operationalization of sustainability in implementation processes to enable sustainment of effective interventions. Our team became proficient at anticipating and responding nimbly to inflection points so that Alberta FICare™ was moved from ideation to sustainment in just 8 years, instead of the typical 17 to 21 years required to move research into practice [67–70]. Our findings advance knowledge about inflection points that are associated with sustainability, by demonstrating how these factors may contribute to sustainment in research and health system contexts. By continuously anticipating and responding to strategic inflection points, researchers and QI evaluators may be better able to manage and support implementation and sustainment of multi-component interventions in complex health systems.

Consistent with Lennox et al., [28] our results support the idea of sustainability as a process that runs concurrently alongside implementation. While maintaining fidelity to the function of the intervention, identification of inflection points in the sustainability process created windows of opportunity to adapt the form of Alberta FICare™ to increase the potential for successful implementation and sustainment. The findings are partially supported by the Dynamic Sustainability Framework [24] because we retained the function of Alberta FICare™ but adapted the form during implementation in the same population and setting. Chambers et al. [24] considers adaptation required for populations and settings other than those for which the intervention was originally designed. Our findings are also partially supported by the EPIS framework [49] because the end point of sustainability was sustainment of a multi-component intervention in a complex health system. Thus, neither theory alone fully explained sustainability as a process. Given the incomplete explanatory power of the Dynamic Sustainability Framework and EPIS framework to our findings, there is an opportunity to further refine theories to better understand sustainability [72].

Research context

Although Klaic et al. [32] may have created an artificial dichotomy in the sustainability process, we organized inflection points by research and health system contexts. The concept of inflection points is similar to bridging factors [73] that can be identified, then systematically tested and proactively leveraged alongside implementation and sustainability processes.

Alignment of Alberta FICare™ with MNCY SCN™ strategic priorities at the outset of the cRCT was an inflection

point. The cRCT funding proposal was endorsed by the MNCY SCN™ and operational and medical leads from each of the 10 level II NICUs included in the trial. This alignment indicated relevance of the Alberta FICare™ cRCT to AHS, and garnered support from the MNCY SCN™ to navigate a complex LHS. Our results align with results from a scoping review [74] that reported the fit between an evidence-based intervention and the implementing system was important to implementation outcomes. Similarly, Braganza et al., [75] guided by the LHS framework, reported that aligning QI initiatives with policy goals led to greater success of national Veterans' Affairs initiatives.

While adaptation of evidence-based interventions and heterogenous operationalization may generate variability in outcomes [28], consistent with other researchers [76], iterative, user-centered co-design was critical to the success of Alberta FICare™. Upon the advice of parents, and clinical and operational stakeholders, the original FICare model [38] was adapted for the level II NICU cRCT. A literature review of co-design as an enabling factor in patient-centered healthcare reported that participatory approaches to design and redesign of healthcare services increased the potential to improve quality and perceived value of services [77]. Arguments maintain that the function or fundamental purpose and desired effects of the intervention are critical, but the form to achieve function may vary [33, 73]. Consistent with this, throughout the cRCT and QI projects, we sought advice to adapt the form to context while preserving the three core components of Alberta FICare™ [36]. Although Lengnick-Hall et al. [73] mention partnerships with agencies, they do not extend this mention to iterative, user-centered co-design like Lennox et al., [28] who consider community and stakeholder participation key to sustainability.

Implementing complex interventions is often challenging due to a poor understanding of contextual factors of the implementing ecosystem. However, there is considerable variability in how context is defined [78], which results in important contextual factors being overlooked. Consistent with a concept analysis of context and implementation by Pfadenhauer et al., [79] we considered context in the cRCT and QI projects as a dynamic phenomenon encompassing the physical setting and social environment. Unlike many studies in the Rogers et al. [80] systematic review that had a limited view of context, in the cRCT post-implementation interviews [44], we assessed context using the Consolidated Framework for Implementation Research [18] to identify barriers and facilitators to plan mitigation strategies for the QI project. Consideration of context is aligned with the function bridging factor dimensions proposed by Lengnick-Hall et al. [73] that highlights the importance

of implementation context. Alberta FICare™ would be considered an optimized intervention [48] because it was implemented, evaluated, and refined in NICUs.

Health system context

We conducted this study in the context of a LHS [46]. Intrinsic to the Menear et al. [7] LHS framework, core values are connected and aligned with multi-level ecosystems of change. An iterative process from practice to data, data to knowledge, and knowledge to practice should result in improved patient and provider experiences and population and health system outcomes [7]. Expanding on the Menear et al. [7] LHS, Kilbourne et al. [81] described an implementation roadmap of successive phases ending in sustainment, where data informed a business case and handoff of interventions to system leadership for maintenance.

In this study, the inflection point of enduring partnerships between university and health system researchers was key to sustainability. Although other researchers [28, 73] include stakeholder participation in their models, these focus on involving stakeholders, not empowering relationships with persons directly implementing and responsible for sustainment of an initiative [82, 83]. With enduring partnerships, both patients, clinicians, and researchers benefited because of (1) increased fit of Alberta FICare™ for patients, families, and HCP, (2) scientific rigor of the intervention and implementation processes, and (3) better understanding of change processes in the ‘real world’ [82]. In addition to the nature of the relationship, we found that the duration of the partnership from the cRCT through to the QI project was key to sustainability. Typically, when research funding ends, university researchers move on to other projects. Although the role of the university researcher shifted from evaluator to advisor in the transition from the QI project to health system operations, the partnership endured.

Ongoing adaptation to ensure relevancy and fit of the intervention with evolving context has been identified as a key element of sustainability [24, 84]. The ability of the Project Team to adapt Alberta FICare™ training content and processes to societal and health system change was an inflection point [84]. Although the Dynamic Sustainability Framework [24] focuses on adaptations for the transportability of effective interventions to other populations and contexts, in our study, we focused on adaptation for the same population (critically ill and preterm newborns) in a similar context (NICU). Yet, these adaptations were key to sustainability and generated additional credibility and value of Alberta FICare™ for clinicians and health system administrators.

Although not common in health services research, the notion of embedded governance was key to sustainability

of Alberta FICare™ in the health system because traditional research governance structures were inadequate to inform and be informed at all levels in the health system [85]. Although complex, a detailed description of the health system organizational structure created a clear direction about how to communicate information and updates across a complex health system and where to seek support should problems arise. Except for a qualitative study in the field of education [85], there is limited evidence of the value of an embedded comprehensive governance structure on sustainability, even in the literature about organizational theories [86]. However, a systematic review [87] pointed out the importance of middle managers in implementation of evidence-based healthcare and outcomes. The value of an embedded governance structure may be a novel finding in the field of implementation science.

Sustaining evidence-based interventions in ‘real world’ conditions requires alignment of the intervention with organizational goals and funding [88]. After we established efficacy of Alberta FICare™ [36], the Project Team shifted strategies from making it ‘easy’ for Local Site Implementation Teams to implement the intervention, to strategies to intentionally integrate the intervention into the health system and prevent erosion following the end of the QI project. A commentary calling for return on research investment in stroke rehabilitation addressed the need for multi-disciplinary, cross-sectoral, and multi-method research that can evaluate interventions across a continuum from clinical trials to the ‘real world’ of the health system context [89]. Similar to other recommendations [28], we used intentional strategies to integrate an effective intervention into the health system, which, alongside implementation, was critical to sustainability and sustainment of Alberta FICare™. Aligned with recommendations from a systematic review of barriers and facilitators of sustainability in hospital-based interventions [90], AHS funded two staff positions to sustain Alberta FICare™.

While this qualitative study was novel in that it used documents from existing projects as data to explore strategic inflection points in research and health system contexts that contributed to sustainment of an effective intervention, there are limitations. First, the disadvantage of using existing documents is the impossibility of following up to explore emerging ideas, as one might typically do with interviews and focus groups. Second, we conducted this research with one initiative: Alberta FICare™ for NICUs. Therefore, the identified inflection points may not be transferable to initiatives in other populations. Third, we undertook the study in a single, integrated LHS in Canada, which limits transferability to other settings. Fourth, we undertook this study from

the perspective of an implementation scientist. Frontline staff and managers in the health system may have a different perspective on individual inflection points that contribute to sustainability. Fifth, more intentional collection of qualitative data may help to build consensus about strategic inflection points that are relevant across implementation multi-component interventions in complex health systems. Finally, we did not identify inflection points that may have decelerated sustainability and sustainment. COVID-19-related pauses caused minor delays in overall progress, but the university-health system partnership mitigated the effects of some of these delays. Future research should address inflection points that suggest abandoning implementation or de-implementation when the aim is sustainment [91].

Conclusions

To ensure return on research investment and generate greater potential to affect patient and provider experiences as well as population health and health system outcomes, as researchers we needed to rethink traditional research and QI structures and processes. We needed to acknowledge that sustaining an effective intervention in a complex health system was different from research. As researchers, we needed to recognize that ongoing monitoring of key indicators after the conclusion of the cRCT contributed to sustainability and, ultimately, sustainment of the intervention. Our key learning from this study was that inflection points in research and health system contexts may assist to accelerate sustainability, and ultimately sustainment, of effective interventions in a LHS. Recognizing strategic inflection points earlier in the implementation process, rather than waiting until the initiative is well underway, may have enabled our Project Team to plan more intentionally to achieve sustainment [48].

Abbreviations

LHS	Learning health system
QI	Quality improvement
FiCare	Family Integrated Care
NICU	Neonatal intensive care unit
cRCT	Cluster randomized controlled trial
HCP	Healthcare providers
ED	Emergency department
AHS	Alberta Health Services
MNCY	Maternal Newborn Child and Youth
SCN	Strategic Clinical Network
EPIS	Exploration, Preparation, Implementation, and Sustainment

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Authors' contributions

Responsible to conceptualize study: KMB. Responsible for implementation design: KMB, DM, PZ. Responsible for intervention content: KMB, DM. Responsible for analysis plan: KMB. Responsible for project management and fidelity to intervention: KMB, DM, PZ. Responsible for ethics applications and reporting: KMB, PZ. Responsible for writing the first draft of the manuscript: KMB, PZ. Responsible for preparation of manuscripts and reporting: KMB, DM, PZ. All authors have critically reviewed and approved the final version of the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to their inclusion of sensitive and confidential health system information but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Alberta FiCare™ cRCT was reviewed and approved by the University of Calgary Conjoint Health Research Ethics Board (ID 15–0067), University of Alberta Health Research Ethics Board (Pro00060324), and Covenant Health Research Centre (ID 1762).

For the provincial quality improvement project, we submitted A Project Ethics Community Consensus Initiative to the University of Calgary Conjoint Health Research Ethics Board. The Board determined it to be a quality improvement initiative and did not require ethics approval.

For this manuscript, the Conjoint Health Research Ethics Board assessed this study as exempt.

Consent for publication

Not applicable.

Competing interests

KMB is the founder of Liminality Innovations Inc, a company to ensure that Alberta FiCare™ (also known as Merge™) is accessible to NICUs across Canada and internationally. PZ received a salary from the Health Innovation Implementation and Spread Fund for the submitted work and was an employee of Liminality Innovations Inc. DM declares no competing interests.

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