A Learning Health System Adoption Engine that Integrates Research and Health Systems

Health systems continue to lag in their ability to quickly and rapidly generate and use existing research to improve the health of the populations they serve, in ways that are affordable, patient centered, financially sustainable, and equitable. Significant and persistent gaps exist in rapidly generating and using evidence and learning supports for all health system stakeholders. These gaps lead to mistakes, wasted resources, inefficiencies and poor health care experiences for patients and health care personnel. Additionally, there is a delayed application of scientific breakthroughs that limit the health benefits that accrue from scientific advances. These delays may widen health inequities experienced by equity deserving groups—groups of individuals who have and continue to face inequities due to factors like race, gender, ability and socio-economic status.

In recent years, it has become a necessity rather than a hope for health systems to rapidly learn from and quickly apply evidence to health care practice and delivery. This is particularly true in Canada where health systems continue to be stretched beyond their limits and are underperforming. Although high quality evidence exists or could be quickly made to help find solutions to these problems, our understanding of the ways and approaches to implementing evidence at scale are lacking.

> **Box 1**
> ## The Learning Health System (LHS) Action Framework
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> This IBH brief provides an overview of the LHS and LHS Action Framework. It highlights the fuel, accelerants, moderators and brakes that allows the LHS to have continuous, interconnected impact on health systems.
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> The framework consists of **5 key gears**:
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> 1) Advanced Analytics and Population Insights;
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> 2) Evidence Syntheses and Curation;
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> 3) Patient Caregiver and Provider Co-Design;
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> 4) Implementation and Reach; and
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> 5) Rapid Cycle Evaluation, Feedback and Adaptation
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> Equity is a core driver of the LHS framework, leading to several key outcomes.

What is a Learning Health System (LHS)?

LHS concept was introduced 15 years ago[1,2] and represents a step towards moving beyond the traditional approach where research passively informs care delivery and 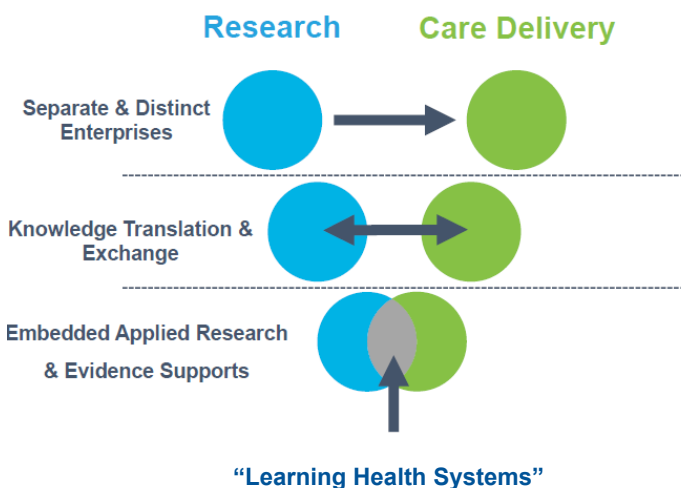both operate in siloes (see Figure 1). The LHS advances this approach and incorporates research within care delivery and actively blurs the boundaries research, quality improvement, and care to speed up evidence use and impact. Feedback from patients, caregivers and communities and data from common sources like electronic health records (EHRs) fuels LHS's aspiration to help create a health care system where evidence is quickly produced, organized, revised and delivered to support local use. This evidence is then readily available for use at patients' bedsides, family rooms, management offices and boardrooms. Although most health systems support LHS's aspirations, instructions on how to move from concept to concrete actions remain under researched. Researchers

Figure 1. Evolution of Research Paradigm

often do not know which complement of methods and approaches are the best to use for different interfaces of the LHS and how best to interconnect with health system stakeholders and decision makers. This brief seeks to deepen readers' practical understanding of the LHS's research-health systems operations interface and offer actionable ways to move LHS into practice. With a focus on creating "whole systems" that integrate across health care delivery sectors and equitably serve defined populations, this brief showcases an action-oriented LHS framework that explains where and how high-quality research evidence, pulled from various scientific disciplines, fits in with health care delivery operations.

A Learning Health System Action Framework

In collaboration with the Ontario SPOR Support Unit (OSSU), LHS Action Framework (Figure 2) was built and refined at Trillium Health Partners' Institute for Better Health (IBH) through a narrative review of the LHS literature and with the help of health system leaders, patients and community members from across Ontario, Canada. The framework is presented as a learning "engine" that creates motion in a production line. The products of this engine are the equity-focused quadruple aim – population health, good health care experiences for patients and caregivers, a sustainable work life for health care providers, affordability—with equity as an overarching goal across all aims. It consists of 5 learning gears and 3 health system gears that describe the intersections of research and care delivery. These gears interlock with each other, resulting in continuous motion.
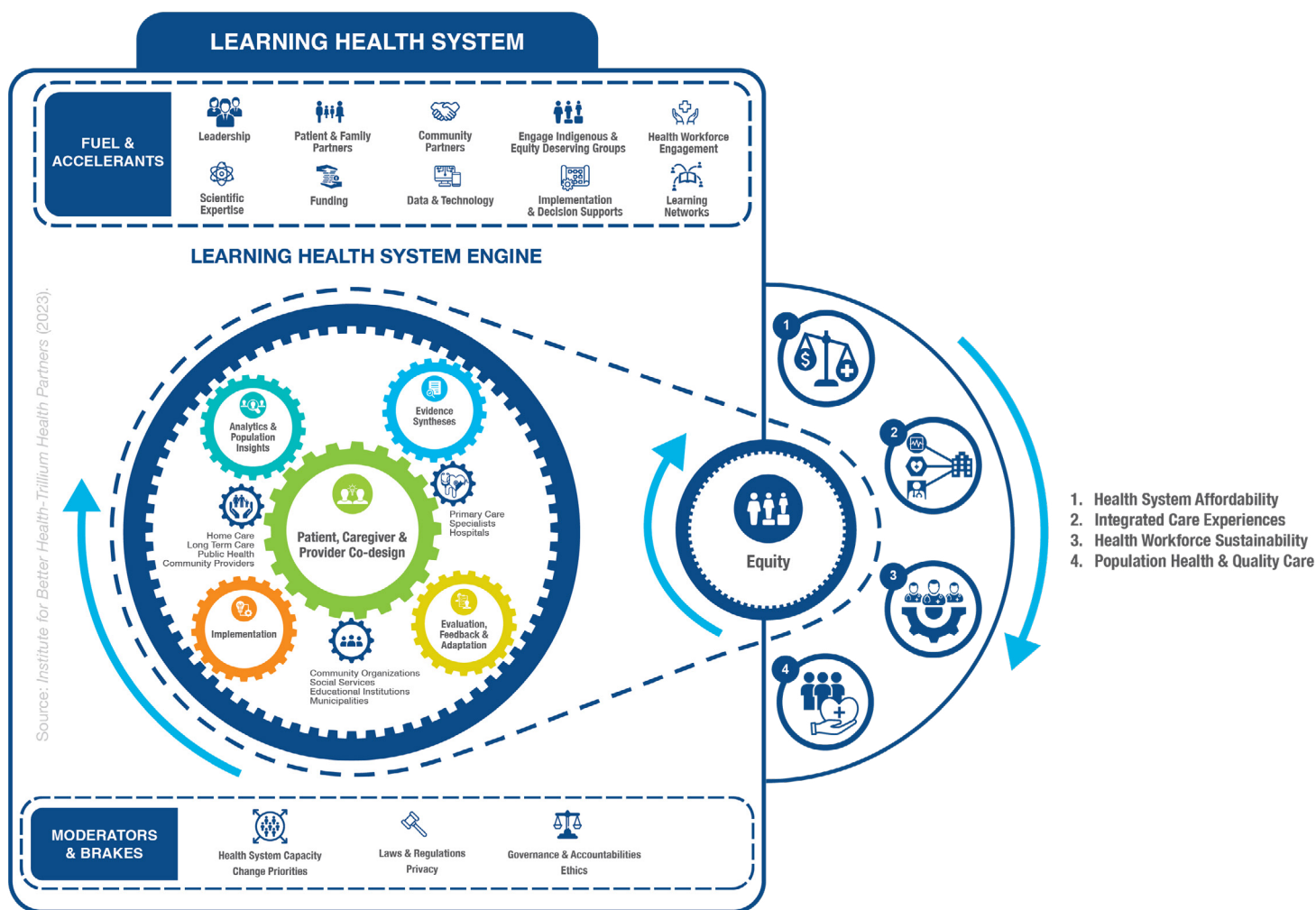

Figure 2. Learning Health System Action Framework

The framework's five "Learning Gears" (sea-green, light blue, green, orange and yellow) represent the various types of research methods and evidence central to iterative learning at all levels of the health system. When they interconnect, the motion created leads to one or more equity-centred quadruple aim outcomes. One type of evidence is insufficient – multiple types are used in complement, in sequence and overtime for the engine to operate. The five gears interconnect with three smaller dark blue health system gears that represent health care sectors that work together. The LHS approaches "whole system" change improvement across the sectors. The 3 health system gears, are: 1) primary care; specialists and hospitals; 2) home care, long term care, public health and community providers; and 3) community organizations, social services, educational institutions and municipalities.

Early examples of the LHS show that the engine requires a constant infusion of "fuel" and "accelerants" that includes resources and capacities (Funding, Scientific Expertise, Data and Technology, Implementation and Decision Supports), as well as mechanisms to engage and promote active participation of key stakeholders (Patient and Family Partners; Community Partners; Indigenous and Equity Deserving Groups; Health Workforce; Scientific Expertise; Health Leaders). In particular, robust mechanisms to engage with equity deserving groups is essential. Equity deserving groups refer to individuals who have and continue to face health care disparities due to their race, gender, sexual orientation and other categories of difference. Learning networks that work across systems facilitate cross-system learning.

The framework also has moderators and brakes that dictate direction, speed and shape its function. These are: Governance; Priority Setting; Health System Learning Capacity; Laws and Regulations; Privacy; and Ethical Oversight. The LHS efforts also need evolved, but robust, governance and accountability mechanisms to identify key learning priorities. Mechanisms to ensure that privacy regulations, ethical principles and local laws and regulations are followed are necessary. These mechanisms must also work in ways that balance the integrity of the base principles with the fast pace anticipated by the LHS.

Equity as an Integral Driver of the LHS Action Framework

Equity is an integral component of the LHS action framework, prompting health systems to ensure care

reflects the diverse array of populations' health needs. Equity is attained when systematic health disparities across quadruple aim metrics are eliminated among groups with different levels of social advantage and disadvantage. All LHS activities must be inclusive of and create value for people from equity deserving groups. The LHS must address deep and persistent inequities and equity deserving groups' well-founded mistrust of health care institutions through active participation with and buy-in from these groups. In order for the learning health system to achieve more equitable outcomes, equity must be addressed within each of the learning gears. When equity is addressed, the engine yields four key outcomes: 1) Health System Affordability; 2) Integrated Care Experience; 3) Health Workforce Sustainability; and 4) Population Health and Quality Care. These outcomes also reflect the quadruple aim and highlights some of the core health system components that impact populations' health and well-being.

The LHS Learning Gears

Gear 1: Advanced Analytics and Population Insights

Advanced Analytics and Population Insights centres on using data to study and understand the nature of the problem/(s). Health care problems are often complex and multifaceted with stakeholders bringing various perspectives to these problems. This gear uses advanced analytic methods to understand the nature of the problems experienced by the populations that the health system serves.

Systems may use sophisticated quantitative research methods (descriptive, predictive, or causal analytics) and include new methods (e.g., machine learning algorithms, equity analyses). The qualitative methods used are also sophisticated and can include ethnographic studies, focus groups, World Cafés, nominal group techniques, community asset mapping and thematic analyses. Researchers and health system operators may collaborate with Indigenous knowledge keepers and Indigenous leaders and use Indigenous sharing circles and Two Eyed Seeing to learn where health care gaps are located. Data are derived and integrated from many sources such as EHRs, community data, patient reported data, social data, census data and interviews. When combined, the data and methods can help identify strengths to leverage and answer questions such as "where are system assets and gaps and what are driving them?" and "where are inequities located?" posed by researchers and health system operators.

Gear 2: Evidence Syntheses and Curation

Evidence Syntheses and Curation supports population analytics by pinpointing the nature and understanding the success or failure of answers to similar problems tested elsewhere, whether at the micro, meso or macro levels. Evidence synthesis products are wide-ranging and include quantitative (e.g. meta-analysis), qualitative (e.g. critical interpretive synthesis), and mixed evidence (e.g. realist synthesis) syntheses and evidence mapping without synthesis (e.g. scoping review). These products also differ in their time-bound nature, ranging from rapid contextualized evidence syntheses to living evidence syntheses that are updated as issues or evidence evolve.

Evidence synthesis-based recommendations via guidelines and technology assessments can be used in learning cycles. Local groups must then decide whether to adopt or adapt these often local or internationally developed assessments.

Existing evidence frequently does not include equity deserving groups. Reviewing what has been learned from current evidence in partnership with patients, caregivers, families and health care providers allows for better contextualization and applicability of the evidence. Where partnerships have not yet developed, LHS actors may partner with community led organizations and community champions who are members of or well connected to equity deserving groups to begin to highlight knowledge gaps and situate evidence while relationships continue to be built.

Gear 3: Patient, Caregiver and Provider Co-Design

Patient, Caregiver and Provider Co-Design is the central component of the LHS. Novel care approaches must be informed by local data and high-quality evidence syntheses that are modified to the local context, and proactively addresses foreseeable barriers to adoption and maintenance. This requires direct engagement and co-design with people impacted by health problems—patients, caregivers, care providers, community members – along with others (e.g., health care professionals, managers) who can influence or are involved in moving the co-designed service, care model, finance arrangement or other innovation towards successful implementation.

Co-design requires thoughtful, deliberate and ongoing engagement where time is taken to build trusting relationships. Key to this gear is addressing power-imbalances so that patients and communities particularly, those from equity deserving groups, feel safe to speak and have their views considered in co-design activities. This may be achieved through early engagement and discussing alignment of goals and expectations, assessing stakeholders' learning needs, eliminating engagement barriers and examining organizations' readiness for engagement.

Researchers use robust research methods for patient-, family- and community-engagement and for participant co-design that sync and intersect with participatory action research and stem from the sciences of consumer engagement and user centered design. Co-design activities are carefully structured and often occurs in the form of group discussions (e.g., focus groups, working groups), structured deliberations (e.g., Delphi panels, future state mapping, stakeholder deliberations, world cafés) and other forms such as design sprints (e.g., rapid design, tackling design problems over 4-5 days).

Gear 4: Implementation & Reach

Implementation & Reach applies scientific methods, stemming from implementation science to help researchers and health system operators avoid common mistakes that can lead promising multicomponent interventions to fail. Poorly expressed or loosely developed implementation strategies (e.g., too complex, inadequately addressing barriers) often leads to suboptimal uptake, failure to adopt new behaviours and poor outcomes. Key to avoiding these common mistakes is using implementation science methods to foster systematic and routine design of interventions and using methods that ensure solutions are evidence-based and aligned to root causes. Additionally, specificity in the target action, context, target, and time, as well as the anticipated implementation outcomes and associated rationale, are all needed to ensure findings can be actioned across essential players.

Many scientific methods and models are available to implementation scientists to use to implement complex interventions. These include the UK Medical Research Council's (MRC) guidance on creating and assessing complex interventions and evidence-based implementation frameworks that operationalize the MRC such as the RE-AIM framework, the Consolidated Framework for Implementation Research, and the COM-B model of behaviour change. Implementation science methods integrate methods from behavioral science, communication, and leadership to guide implementation, adoption and maintenance. Embedding health equity perspectives and partnerships into this work is paramount to ensure attention is paid to implementation disparities, so that implementations of innovations not only reach but generate meaningful impact for equity deserving populations.

Gear 5: Rapid Cycle Evaluation, Feedback, and Adaptation

Here, LHS evaluators rely heavily on realist evaluation methods, using a combination of qualitative, quantitative, and hybrid approaches, staged at the developmental, formative, and summative stages of implementation. A central gear 5 focus is to measure how well a multicomponent invention is working for which patient population, and under what conditions.

Logic models can help focus evaluation measurements on important inputs, intervention design components and resulting processes and outcomes from the short, mid and long term. Evaluators need to also capture vital contextual factors such as competing demands and exogenous events. To enable rapid cycle change, early feedback of preliminary data to implementation teams is key so that early changes can be made to the intervention and or implementation strategy.

References

1. Etheredge, LM. A rapid-learning health system. Health Affairs 2007; 26, W107-W118.

2. Institute of Medicine. The Learning Healthcare System: Workshop Summary (IOM Roundtable on Evidence-Based Medicine): The National Academies Press, 2007. Published online 2013. doi:10.13184/eidon.39.2013.89-91

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