


## RESEARCH REPORT

# Fostering the use of Learning Health Systems through a fellowship program for interprofessional clinicians

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**Abstract**

**Introduction:** To address Australian workforce needs, we developed a Learning Healthcare System (LHS) Academy fellowship program for clinicians. In the Academy, fellows complete foundational coursework, an LHS project, and other professional development deliverables to foster their future as digital health champions within their organizations. In this paper, we describe the 11-month-long program, as well as our evaluation results from the first 2 months of the program.

**Methods:** In the first week of the program, we sent all fellows an open-ended survey asking fellows to describe their digital health professional identities and what they expected to achieve from the fellowship program. At 2 months, we sent a follow-up open-ended survey that captured identical measures, their perceived barriers to participation in the program, perceived use of topics in the workplace and to their projects, and recommendations for program improvement. We analyzed the open text responses using qualitative content analysis, to identify categories of responses.

**Results:** Overall, 2 months into the program, it was evident that participants were finding the teaching model engaging, useful, valuable, and applicable to their work and projects. Fellows perceived barriers to engagement in the program as balancing other commitments, lacking technical expertise, and having difficulty seeing themselves as leaders. Fellows expected that the program will allow them to implement new models of care, provide them with enough expertise to become leaders and champions in digital health, and become mentors for future generations. As far as changes in their professional identity, there was a notable increase in the number of fellows perceiving themselves as leaders.

**Conclusion:** Fellowship programs are one promising means of developing the healthcare workforce in LHS capabilities. Future studies should describe and evaluate LHS programs, to provide insights and recommendations for other educators interested in implementing similar programs of work within their own institutions.

**KEYWORDS**

curriculum, fellowship, healthcare, Learning Health Systems, program, workforce development

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## 1 | INTRODUCTION

Healthcare leadership around the world has called for the digital transformation of health at all levels of the healthcare system.<sup>1-3</sup> One key driver to digitally transforming healthcare is workforce development in digital health, clinical informatics, leadership, implementation science, and more. There is a need for a critical mass of appropriately skilled professionals with the capability to build communities that can leverage resources, interrogate the mass of data generated by routine healthcare and drive clinical practice improvement, through the translation of research and evidence into practice.<sup>4</sup>

The Learning Health Systems (LHS) concept is a useful framework to teach professionals how to digitally transform healthcare.<sup>5,6</sup> First coined by the National Academy of Medicine in 2007, Learning Health Systems (LHS) is a relatively new concept defined as a dynamic system with the opportunity for increasing the value of healthcare through rapid and continuous cycles of study, feedback, learning from data and immediate translation to practice and policy, regardless of the original intention of the data collection.<sup>7,8</sup> The framework includes best practices for how to nimbly interrogate the data from practice, generate new knowledge, use this knowledge to rapidly inform and implement interventions into practice and change practice to measurably transform services and patient-care outcomes.<sup>9</sup> Thus, the cycle constantly iterates new data-driven solutions for the problems currently faced by health service delivery, to inform practice.<sup>10</sup>

As LHS is focused on inter-disciplinary work, the LHS concept can be taught to both digital health and informatics generalists and specialists, clinicians and non-clinicians, front-line workers, and upper management. In the literature, descriptions of LHS education programs focus on PhD students,<sup>11</sup> post-doctoral students,<sup>12</sup> and clinical fellows<sup>13-15</sup> in the United States<sup>11,13-15</sup> and Canada.<sup>12</sup> Our previous description of an LHS short course focused on an interdisciplinary course for clinicians, researchers, and IT professionals in Australia.<sup>16</sup> Through this paper, we contribute to this emerging literature by describing an LHS Academy fellowship program in Australia.

The purpose of this paper is to describe a fellowship program to develop LHS skills in Australian clinicians through didactic coursework and project-based learning. We also outline preliminary evaluation results from the first 3 months of the 11-month program. By describing our program and the preliminary evaluation, we believe current and future educators can learn from our experience when building their own programs. Additionally, our paper will contribute to the emerging education literature on how to foster Learning Health Systems through workforce development and education. Compared to previous publications on LHS education programs, we are contributing novel insights to this literature in several ways. To the best of our knowledge, we are one of the first groups to share preliminary evaluation data from an education program like this. Furthermore, we are adding diversity and new perspectives to this literature due to our location (ie, Australia), the health system data infrastructure (ie, recent or current electronic medical record implementations), our participants (ie, interprofessional, less formal research experience), the interdisciplinary mentorship model (ie, clinical and non-clinical experts),

and the breadth of organizational sites involved (ie, primary care GP clinics and several tertiary hospital sites).

### 1.1 | Description of the Learning Health System Academy (LHS Academy)

As one of the first steps toward LHS workforce development in Australia, we launched a year-long project-based fellowship program - the LHS Academy. The program was built as a collaboration between the University of Melbourne (UoM) and Melbourne Academic Centre for Health (MACH) affiliated health services, which includes six public hospitals and a general practice research and education network. Initial program ideas were inspired by programs such as the Health Infrastructure and Learning Systems (HILS) program from the University of Michigan and then adapted to our context and needs. Similar to the HILS program, we opted to include both coursework and project components to teach the essential skills in LHS and to provide opportunities for application of those concepts through project work.

Since a known barrier to participation by healthcare professionals in continuing education programs is protected time, we began by developing a successful business case to direct philanthropic funding held by the UoM to provide protected time and backfill of clinical duties of the participating fellows. The funding was used to create scholarships that provided funding to backfill clinics and hospitals so that LHS Academy participants (fellows) could spend 2 days per week in the Academy. Additional funds were budgeted to employ a full-time project coordinator to oversee the program delivery, manage fellow-mentor relationships, organize and run workshops, and manage meetings, and ongoing deliverables. Additionally, extra funds were allocated toward professional development activities for the fellows. The business case secured funding for 10 fellows from seven healthcare organizations.

Each health organization recruited and selected their fellow(s) through a standard written application process. The application included a brief project proposal and evidence of both executive and clinical sponsorship for both the applicant and their proposed improvement project. The application also included a commitment by their sponsoring organization or group to provide in-kind resources that would support the career progression of fellows, for example through mentoring. Additionally, a commitment to continue the projects beyond the timespan of the Academy, for example through the engagement of the organizational stakeholders needed to embed the improvement project into the healthcare service. In some organizations, a committee selected a fellow from the written applications, whereas other organizations elected to hold interviews or oral presentations before selecting the fellow. Project feasibility was not a significant dimension of the application assessment as time was explicitly built into the coursework phase of the program to design, scope, and refine projects to enable significant progress to be made in the time-frame of the 11 months of the Academy program.

The LHS Academy program was designed to equip healthcare professionals with the practical skills to work with data and digital

**TABLE 1** Learning outcomes for the LHS Academy

Learning outcome (LO)	Description
LO1	Demonstrate an understanding of digitally enabled LHS concepts through a simulated case scenario (ALHS foundation course)
LO2	Design a high-quality digitally enabled LHS project that applies health informatics principles and methods
LO3	Form and maintain a digital transformation learning community with key stakeholders
LO4	Lead a digitally enabled LHS project at their workplace setting
LO5	Disseminate their project to their key stakeholders and sponsors
LO6	Write a written report of the LHS project outcomes
LO7	Formulate a personal leadership development plan within their workplace
LO8	Enhance their visibility and professional networks in informatics and digital health

health technologies to ultimately improve patient outcomes. Given that Australia currently lacks a sufficient number of positions in leadership and championship in digital transformation, the program was designed to build new roles and future career pathways for the fellows. Specifically, the program aimed to foster digital health champions as described in Australia's 2020 National Digital Health Workforce and Education Roadmap.<sup>17</sup> We aimed to create leaders who will continue to solve new problems; mentor new cohorts of fellows; become the face of digital transformation in their organization; and grow the pool of skilled and knowledgeable digital health advocates who can lead and advise on digital health initiatives.

The curriculum for the LHS Academy was co-designed by subject matter experts, partner organizations, and learning specialists. The learning outcomes for the program are listed in Table 1. An overview of the curriculum and year-long program components is included in Figure 1. During the program, fellows spend 2 days a week on the 11-month long program, from February to December. First, the fellows enter the program with a broad LHS project idea and workplace mentor. Our program then pairs the fellows with an appropriately experienced academic mentor. It is expected that the mentoring teams meet bi-weekly and provide feedback to fellows on all program deliverables.

Early in the program, the fellows participated in an Applied Learning Health Systems (ALHS) foundations course for the first 2 months. The description of this course is published in Choo et al.<sup>16</sup> The course involved a flipped classroom model of 3 h of individual asynchronous learning, followed by 3 h of blended-synchronous workshops and 2 h of project-based application inquiry sessions, 2 days a week for 13 LHS-related topics. The full curriculum is illustrated in Figure 2. Concurrent to completing this foundational course, the fellows prepared a project proposal and undertook ethical approvals. Throughout

the year, fellows meet with their workplace and academic mentors for guidance on their projects relating to design, methodology, and technical aspects.

Following the foundational coursework component, the fellows participate in a weekly workshop series entitled "Making Digital Health REAL"—a practical insight workshop series. It is compulsory for LHS fellows to attend and the series focuses on four general streams (Career Path, Industry, New Innovations, and Consumer Engagement). Each workshop includes 1-h talks and related activities led by industry leaders and the program coordinator.

Fellows are also asked to develop a digital health professional portfolio comprising of a digital champion personal development plan and networking plan which outlines how they will be building their network, professional profile, and learning community, and describes the activities they will undertake to build this skillset and profile. At the end of the program, after the year-long training, each fellow will submit their professional portfolio, which is comprised of all the outputs for the year: project proposal, project report, project presentations, networking and development plan, professional development-related activity outputs, resume, and their ideal position description (Figure 1).

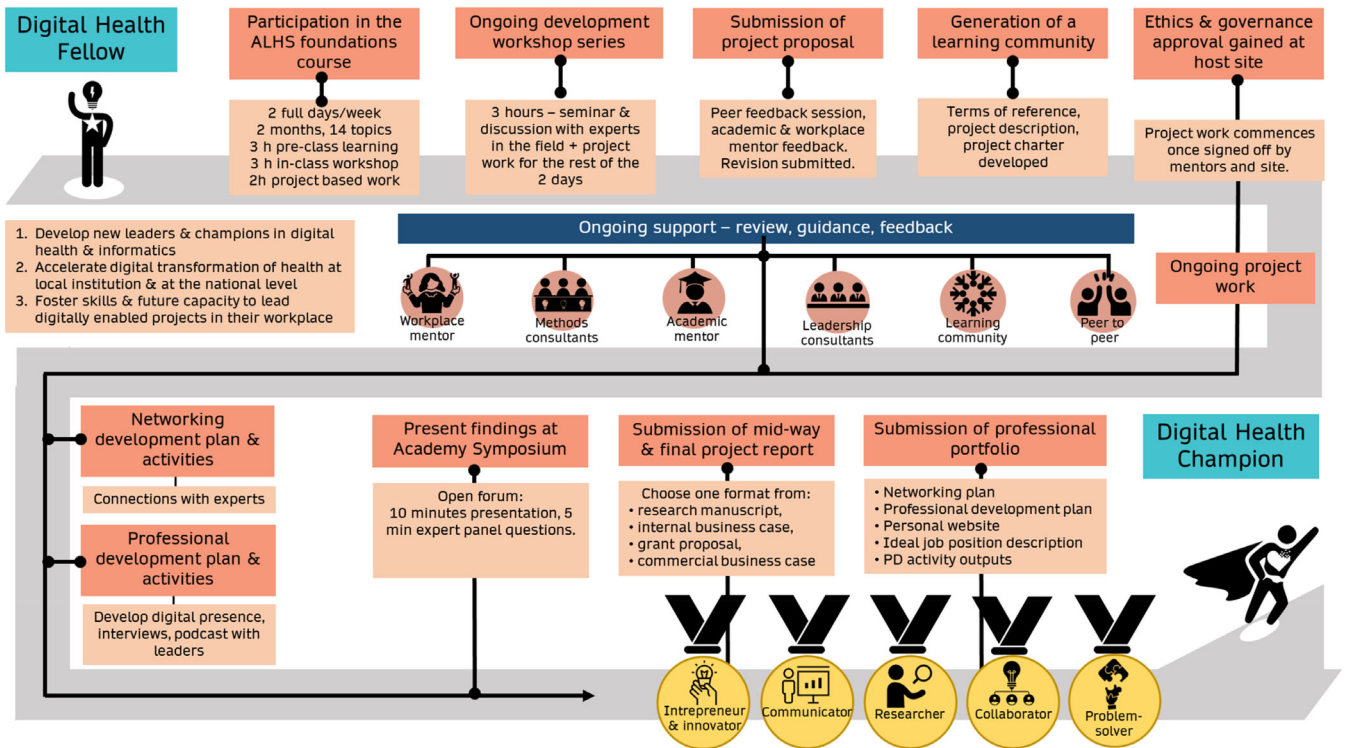
By describing the fellowship curriculum, current and future educators could consider similar elements for their programs. Beyond description of curriculums, it is also important to investigate participant experience and evaluate what curriculum elements are most beneficial. In our initial evaluation, we aimed to answer the following questions.

- Entering the LHS Academy program, what were fellows' expectations and previous experience with LHS?
- After 2 months of the program, what did fellows perceive as their barriers toward engaging in the program?
- How did fellow's digital health professional identities evolve from their participation in LHS coursework?
- What did fellows perceive as the benefits and suggested improvements to the LHS foundational course?

## 2 | METHODS

The study population for this research project was 10 health professionals undertaking the LHS Academy fellowship program. The fellows were given the choice to opt-out of participation in the evaluation and all topic feedback surveys were voluntary. This study was approved by the University of Melbourne Ethics Committee.

The open-ended questions included demographic questions and questions related to our research questions. Surveys were designed and distributed via Qualtrics. Participants were invited to complete the surveys through emails and the Learning Management System prior to starting the program and following the completion of the foundational coursework material. All data were collected through Qualtrics. In order to undertake data cleaning, the Qualtrics data were



**FIGURE 1** Overview of the year-long LHS Academy fellowship program. Fellows participate in a year-long program consisting of coursework, workshops, professional development activities, ongoing mentorship, and project work. At the end of the program, they choose what format they would like to present their project findings in. Fellows present their projects at an end-of-year open forum symposium and submit their final professional portfolios with the various deliverables posed throughout the year. Following the year of training, they are now considered “digital health champions,” with the skills to undertake continuous LHS projects and transform the healthcare system

Domains of the LHS	P2D Setting up a Learning Health System project			D2K Data to knowledge			K2P Knowledge to practice			P2D Practice to data			Repeat the cycle
Topics	Topic 1: Identify the problem & establish a learning community	Topic 2: Emphasise with end-users and define the problem	Topic 3: Establish infrastructure for a LHS project	Topic 4: Identify data sources & digital phenotypes	Topic 5: Transform and prepare data	Topic 6: Analyse the data	Topic 7: Interpret model output and design risk stratification	Topic 8: Synthesise insights & design a digital solution	Topic 9: Map & specify solution components	Topic 10: Develop and test solution	Topic 11: Identify & clarify the problem. Design an evaluation plan	Topic 12: Implement the intervention	Topic 13: Translate learning and digitally transform health service
Goals	Access, extract, map and represent health information for analysis			Analyse health data to generate knowledge			Make knowledge actionable and shareable	Generate tailored messages for decision making	Implement trial in accordance with regulatory and ethical requirements		Evaluate interoperability, scalability and sustainability of intervention		
Steps	Identify your key subject matter experts. Establish your learning community.	Consult and interview key stakeholders to understand the problem and identify common pain points for clinicians and users.	Create databases, check data storage and data security.	Define phenotype, identify data sources, access/extract data.	Clean and parse data. Generate analysis ready data. Design detailed data analysis plan.	Apply and compare analysis methods in an accessible, replicable and interpretable way. Visualise, interpret and report results and implications of analysis.	Interpret outputs from various models. Design risk stratification models.	Co-design with stakeholders. Engineer knowledge for decision support solution. Develop solution components and validate with users. Build and validate secure & interoperable data exchange pathways.	Validate solution in a simulated setting. Validate solution in a pilot setting.	Design a robust clinical trial. Determine outcomes to be measured. Design an evaluation framework for a complex intervention.	Develop an implementation plan. Identify key stakeholders.	Determine the integration capacity. Develop a continuous assessment framework. Assess scalability and sustainability at system, practice, process and patient level.	
Key considerations	People			Process			Policy	Technology		Innovation			

**FIGURE 2** ALHS foundational coursework curriculum overview. Following the LHS cycle of data to knowledge to practice to data, the following topics were developed. The curriculum takes learners through the process of developing a learning community to then identify a problem to work on and all the way through to the implementation of that solution and evaluation of its success and scale up. In this course, we teach these concepts through the application to a diabetes case scenario, which we return to each week at different phases of the project's implementation. At the end of each workshop, we ask fellows to consider how they will apply the learnings to their own work and projects

**TABLE 2** Summary of thematic coding and coding frequency for the pre-survey

Theme	Code	Number of participants (N = 10)
Previous knowledge and experience with LHS	Previous quality improvement projects	N = 2
	Previous implementation projects	N = 3
	No previous experience	N = 4
Future applications to fellows' workplace	Implementation of new models of care	N = 6
	Desire to become a leader and/or champion	N = 3
	Learn about data science and digital health technologies	N = 4
Evolving digital health identity and perceived role	Subject matter expert	N = 3
	Implementer	N = 4
	Leader and/or champion	N = 5
	Problem solver	N = 2

exported as an excel file. Data cleaning was performed by removing any missing or incomplete data. Ambiguous data were followed up with the participant and kept if discrepancies were able to be resolved or excluded if an adequate solution was not met. We analyzed the responses to open-ended survey questions through qualitative content analysis. Two coders independently coded the text responses and then met to resolve discrepancies and solidify categories under each research question.

### 3 | RESULTS

#### 3.1 | Demographic descriptive data

Ten fellows were chosen for the Academy. The 10 Fellows were from diverse professional clinical backgrounds, including Endocrinology (N = 2), General Practice (N = 2), Anaesthesiology (N = 2), Psychology (N = 1), Nursing (N = 1), Pediatrics (N = 1), and Pharmacy (N = 1). The fellow's projects included a virtual care app for diabetes management in pregnancy; electronic health record domestic and family violence information sharing during antenatal care in general practice; developing a virtual portal for patient information for surgical procedures; developing coordinated care systems for STI care in general practice; a suicide risk assessment tool integration into standard care; heart attack management communication across platforms; quality improvement for prehabilitation and rehabilitation based on surgical data; improving value of care using EMR data in Pediatrics; and developing assessment and reporting tools for quality medication use in the EMR. Ten participants completed the pre-survey and 10 participants completed the post-survey.

#### 3.2 | Entering the LHS Academy program, what were fellows' expectations and previous experience with LHS?

Fellows were asked to explain their previous experience with LHS, digital health, and health informatics concepts, through which a few themes emerged (Table 2). Broadly speaking, fellows fell into three categories, with none having specific previous knowledge or expertise with LHS: experience with a previous implementation project (n = 3); experience with a quality improvement project such as audits (n = 2); and finally no previous experience (n = 4).

The fellows were asked to describe how they expected to apply the concepts and tools learned in the Academy to their workplace (Table 2). Many fellows expressed that they hoped to implement new models of care in their workplace and beyond (n = 6). Some fellows also indicated that they hoped to become leaders and champions within their organization to create pathways for ideas and to guide the direction of solutions (n = 3): "I would hope to use the knowledge gained to be a champion and provide leadership in the current clinical position that I occupy. I would eventually hope to be in a position to educate and mentor others in my workplace." Others hoped to gain a better understanding of data science and digital technologies to foster a culture of systems improvement (n = 4).

#### 3.3 | After 2 months of the program, what did fellows perceive as their barriers toward engaging in the program?

Given that the Academy required a full year's commitment from clinicians, we explored what barriers they perceived as impacting their participation (Table 3). Responses to this question were quite varied with fellows citing several different barriers: juggling busy schedules and work commitments (n = 3); difficulty seeing themselves as a leader (n = 2); a lack of technical expertise to carry out the project (n = 2); balancing other educational commitments (n = 1); re-adjusting to return to study after a period of time away (n = 1); and resourcing constraints (n = 1). One fellow wrote, "personally I have never seen myself as a leader or champion so I may be my biggest barrier at times," another wrote, "I think I may have difficulty in achieving professional development goal as I rarely do network with people (probably due to my personality trait) and do not feel comfortable in promoting myself."

#### 3.4 | How do fellow's digital health professional identities evolve from their participation in LHS coursework?

There was a notable shift in the number of fellows seeing themselves as "leaders" or "champions" (Table 2 and Table 3). At the start of the course, only half (n = 5) saw their role as being a leader or champion, whereas 2 months into the program, following the foundations

**TABLE 3** Summary of thematic coding and coding frequency for the mid-program (2-month) survey

Theme	Code	Number of participants (N = 10)
Barriers to engagement in the program	Work commitments	N = 3
	Family commitments	N = 1
	Lack of technical expertise	N = 1
	Difficulty viewing themselves as a leader or champion	N = 2
	Other study commitments	N = 1
	Returning to study	N = 1
Application of coursework to fellows' project work	Greater awareness of methods available	N = 6
	Greater application of concepts to projects	N = 3
	Better structure of project	N = 3
Evolving digital health identity and perceived role	Implementer	N = 2
	Connector	N = 5
	Leader and/or champion	N = 10
Foundations course—benefits	Value of the teaching model	N = 6
	Knowledgeable faculty in instructors	N = 3
	Appreciation of the LHS concepts	N = 6
	Direct application to workplace role	N = 4
	Protected time for the Academy	N = 1
Foundations course—suggested improvements	More spaced-out curriculum delivery	N = 6
	More application to workplace project	N = 2
	Additional topics	N = 5
	Building a community	N = 1

course, all fellows (n = 10) described their role as a leader or champion. Fellows also described their role as advocating for and driving projects forward; exploring new and innovative opportunities; and inspiring and supporting other clinicians on their digital health journey. For example, one fellow described their role as being “able to be an advocate to help primary care clinicians access and have a role in developing digital health innovations... so that I can learn enough to be able to support other GPs interested in building digital solutions to clinical problems.” Another shift in identities was the disappearance of fellows seeing themselves as subject-matter experts (n = 3) and changing their descriptions closer to connectors (n = 5) 2 months into the program. One fellow's description represented this phenomenon—

“I see my role as initiating and driving forward digital health projects, but recognising the limits of my expertise and knowing which people within the organisation to draw upon to progress specialist elements of the project.”

### 3.5 | What did fellows perceive as the benefits and suggested improvements to the LHS foundational course?

Fellows were asked how they would use the coursework to inform their LHS projects. There were three main themes identified in terms of how fellows recognized their application of their learning in the foundations course to their projects (Table 3): the coursework gave them a greater awareness of the methodologies available (n = 6), the coursework allowed them to apply the concepts learned (n = 3), and it gave them a better understanding of a structure for their project work (n = 3). Overall, this highlights that the coursework component did support their learning and enhanced the quality of their projects: “overall, after the short course my project has completely changed from my original application, in part to be more realistic in scope, but also to incorporate some of the learnings of the short course.”

In general, when asked about the benefits of the foundational course, six fellows described the value of the LHS concepts. Six fellows also appreciated the course teaching model. For instance, one fellow wrote, “I have found the sequence of learning each step of the LHS process so valuable. Each week felt like it built on the previous week in a way that was really easy to follow. Having the roadmap at the top of each session was really valuable in orientating and contextualising the week's learnings in the broader structure of the LHS.” Lastly, fellows appreciated the expertise of the instructors (n = 3) and protected time to work on the projects and Academy (n = 1).

In relation to suggested improvements, there were a few recurring themes: spacing out of the coursework delivery (n = 6); additional topic requested (n = 5); and clearer explanation of how concepts could be applied to their own workplace (n = 2). Fellows wrote, “Perhaps space the course out a little bit. I would have liked to have had a bit more time between the topics to do some reading and research outside of the pre-class material, prior to the class,” and “I felt very rushed to apply all of the learnings to my individual project.”

Overall, participants were highly satisfied with the flipped classroom model of 3 h of pre-class learning before engaging in hybrid face-to-face/Zoom workshop for 5 h. Participant suggestions for improvements were generally small. Most major recommendations included additional topics, for example, data collection, data storage, data analysis/analytics, artificial intelligence, co-design, and exploring other types of digital health apps. Interestingly, the desire for more data science curriculum was a recurring theme: “I found some of the more data heavy sessions really interesting but also felt like a fair bit went over my head. I think it would be really valuable to have a further course on data science for clinicians, with an understanding that it is something many of us don't know a lot about.” This highlights the need to teach more big data analytics techniques to clinicians, in order

for them to be able to apply these skills, for example, to electronic health record data interrogation and ultimately understanding and interpreting these insights for practice improvement. This indicates that overall, the foundational coursework format was not perfect for each person, but largely met the needs of a very diverse audience of health professions and aided in informing their project designs to follow an LHS format.

## 4 | DISCUSSION

For a group of 10 fellows who had relatively little experience with LHS concepts, they are finding the fellowship program beneficial for themselves and their workplaces. Although we could only provide an investigation of 2 months into the program, we learned the importance of providing a coursework in the beginning of the program and how much their professional identities can shift. The foundational LHS coursework made them aware of new methods, frameworks, and structures that they immediately apply into their project proposals. This group's lack of awareness of the LHS concepts further highlights the need for such a foundations course in raising awareness of the models that can be adopted in healthcare quality improvement.

Of interest, the identity of the champion or leader seemed to be an important mechanism for completing LHS projects. Several fellows described that not always seeing themselves as a leader or a champion had been a barrier for them in this program. However, within 2 months of this program, even these fellows were describing their role in healthcare as digital health champions and leaders. This phenomenon is interesting but not surprising, as LHS projects require working with multiple disciplines, professions, approaches, frameworks, problems, solutions, and much more. We are learning from our fellows that conducting an LHS project requires them to be comfortable with being uncomfortable. These are important lessons for other current and future programs to consider.

### 4.1 | Lessons learned

Beyond this 2-month investigation, the authors have learned additional lessons. The first lesson is how to best collaborate with the health organization sites. Except for the foundation course and workshops, the project-based learnings component is largely undertaken at the organization sites. As external partners to the Centre, processes were employed to ensure desired outcomes were mutually achieved by both the organization and Academy. There is a significant financial commitment that is required to support the fellows for 2 days of Academy work, for 1 year. In many cases, shuffling or backfill of roles is required, which adds additional pressure to the institution's workflow. Significant lead time is required to ensure that institutions have enough time to plan human resources and budget for ongoing workflow and remuneration costs. Processes that warrant change for next year's iteration of the Academy include the commencement of the recruitment process for future LHS Academy fellows earlier (at least

6 months in advance); strengthened recruitment process for mentors and sponsorship for further buy-in from institutions; and increased collaboration with Clinical Informatics Directors to determine and address factors associated with LHS project implementation (digital maturity and organizational readiness), starting with the inclusion of Learning Communities in practice.

The second lesson is the importance of co-designing the program with the fellows themselves and their mentors. Our Academy Project Officer meets with groups individually and together. Throughout a fellowship program, it is important to check in on the progress of each fellow and ensure the program is meeting expectations. Moreover, it is essential to have a program logic that clearly outlines all of the project's roles, goals, activities, milestones, deliverables, and expected outcomes. Furthermore, to ensure accountability, there needs to be regular submission points as well as feedback and reflection points so that improvement can occur, and to ensure that the projects stay on track. Finally, in order to evaluate the impact of these leadership programs and projects on the individual and institution, an evaluation program needs to be in place from the beginning, to capture the changes along the way. This is especially important in the first year of a new program.

The third lesson encompasses the following three important elements for fellowship program curriculum design: spacing, scaffolding, and structure. We did not space out our coursework enough to allow fellows enough time to apply each learning to their projects. Future iterations of the fellowship will space the coursework out and make these connections explicit. We learned that fellows who have no background in LHS concepts need significant scaffolding materials, tools, tips, feedback, and frameworks. In our deliverable documents, we provided prompting questions as scaffolding. However, future iterations also need to include descriptions for how to approach a deliverable and teaching fellows what "quality" looks like. Lastly, fellows appreciated any structure and yearned for more structure in the program. Since LHS is a steep learning curve, it is imperative to sequence learning appropriately and break complex topics into smaller, more structured "how-to" pieces.

Lastly, creating these digital workforce development programs and building a critical mass of skilled professionals will inevitably lead to increased desire by these groups to create learning communities that undertake several improvement projects within their organizations. As such, organizations need to ensure that they to keep up with the demand from this newly upskilled workforce, by having the necessary infrastructures in place, ahead of time, to enable this work: from the people (expert oversight, management, innovative thinkers, support staff), to the processes (workflows), the technologies (appropriate tools, information technology support, systems, and interoperability), and the necessary governance structures (ethics, policy). Ultimately, with an infinite number of competing priorities for institutional budgets, a clear business plan with a cost-benefit analysis of the value of upskilling and undertaking LHS will be required to convince funding bodies and administrators of the advantages of investing in and implementing such models in standard practice.

## 4.2 | Future directions

In the long term, we will continue to use program evaluation methods to continuously improve this program and evaluate the impact it has on health organizations. As previously noted, there is a lack of published evaluation data for these emerging LHS education programs. If the field commits to undertaking and sharing rigorous evaluations of these types of LHS programs, then program designers can more efficiently learn from others' barriers and strategies. For example, program evaluations could leverage previously published methods (eg, interviews), tools (eg, previous surveys), outcome measurements (eg, employment, outputs, funding), and learning measurements (eg, self-efficacy, feelings of belonging).

Moreover, it is possible that a 1-year program is not substantial enough to fully develop these skills. Thus, it is imperative for individual specialty colleges to consider incorporating longer, formal training programs into their accreditations. Our Centre will continue to advocate for formal fellowship accreditations and consider longer training programs.

A program of this nature requires a high level of buy-in and incentivization for the host institutions that are nominating a fellow and project. As addressed in learnings, there is a significant financial commitment required to support the fellows from institutions. The current healthcare workforce is in need of significant development in order to keep up with emerging technologies, interrogate data, and rapidly learn from it to improve practice, and to participate and lead the digital transformation of health. Our LHS Academy provides a local solution. Other institutions around the world should consider adapting elements of this program and other LHS programs.

At the national and international level, we require a large critical mass of appropriately skilled workforce that can undertake the challenge of working in LHS. It is obvious that this extends beyond just fostering 10 local digital health champions a year. Creating a critical mass of skilled workforce in digital health will be a multi-pronged approach. There is a need for collaborators, subject matter experts, advocates, and change agents at all levels of the workforce. As such, further investment is needed in ongoing professional development programs that teach LHS concepts to the workforce in an applied manner, which can be adapted to their own workplace problems. Outside of professional development, incentive for participation in such programs will lie in the propensity for programs to be accredited by formal professional bodies or providing recognition for continuous professional development. However, without a clearly defined career pathway and associated formal education structure, it remains that impetus to undertake such programs will be limited. Future work within our Centre involves delivering a Professional Certificate, with the intention that past participants of our programs can get recognition of prior learning and undertake the formal assessment component to gain the award program from the university.

## 5 | CONCLUSION

There is still a long way to go for the digital health field in recognizing specific and defined positions for these roles. Our study aims to describe a model which can be adopted by other institutions, as a catalyst

to drive this process of workforce development. In this paper, we have only described one approach to a digital health leadership program. Additionally, we only describe the partnership between academia and health service. There are many other partnerships such as those with industry that could be harnessed to transform practice with applied projects. This is a call to action for other groups to present their model of education to inform future programs of work and in the long-term influence policy and practice in terms of adopting LHS as the standard model of practice improvement in healthcare institutions.

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### CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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