


# Barriers and facilitators to learning health systems in primary care: a framework analysis

Georgia Fisher ,<sup>1</sup> Maree Saba,<sup>1</sup> Genevieve Dammery,<sup>1</sup> Louise A Ellis,<sup>1</sup> Kate Churruca,<sup>1</sup> Janani Mahadeva,<sup>2</sup> Darran Foo,<sup>1,2</sup> Simon Wilcock,<sup>2</sup> Jeffrey Braithwaite<sup>1</sup>

**To cite:** Fisher G, Saba M, Dammery G, *et al*. Barriers and facilitators to learning health systems in primary care: a framework analysis. *BMJ Health Care Inform* 2024;**31**:e100946. doi:10.1136/bmjhci-2023-100946

► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/bmjhci-2023-100946>).

Received 23 October 2023  
Accepted 01 June 2024



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

<sup>1</sup>Centre for Healthcare Resilience and Implementation Science, Australian Institute of Health Innovation, Sydney, New South Wales, Australia

<sup>2</sup>MQ Health General Practice, Macquarie University, Sydney, New South Wales, Australia

## Correspondence to

Dr Jeffrey Braithwaite;  
[jeffrey.braithwaite@mq.edu.au](mailto:jeffrey.braithwaite@mq.edu.au)

## ABSTRACT

**Background** The learning health system (LHS) concept is a potential solution to the challenges currently faced by primary care. There are few descriptions of the barriers and facilitators to achieving an LHS in general practice, and even fewer that are underpinned by implementation science. This study aimed to describe the barriers and facilitators to achieving an LHS in primary care and provide practical recommendations for general practices on their journey towards an LHS.

**Methods** This study is a secondary data analysis from a qualitative investigation of an LHS in a university-based general practice in Sydney, Australia. A framework analysis was conducted using transcripts from semistructured interviews with clinic staff. Data were coded according to the theoretical domains framework, and then to an LHS framework.

**Results** 91% (n=32) of practice staff were interviewed, comprising general practitioners (n=15), practice nurses (n=3), administrative staff (n=13) and a psychologist. Participants reported that the practice alignment with LHS principles was influenced by many behavioural determinants, some of which were applicable to healthcare in general, for example, some staff lacked *knowledge* about practice policies and *skills* in using software. However, many were specific to the general practice environment, for example, the *environmental context* of general practice meant that administrative staff were an integral part of the LHS, particularly in facilitating partnerships with patients.

**Conclusions** The LHS journey in general practice is influenced by several factors. Mapping the LHS domains in relation to the theoretical domains framework can be used to generate a roadmap to hasten the journey towards LHS in primary care settings.

## BACKGROUND

Primary care is the ‘frontline’ of healthcare; it is the first point of contact with the health system for most people<sup>1,2</sup> and thus an essential component of care delivery. Primary care can reduce overall health costs and relieve pressure on other areas of the health system; for example, by reducing the number of preventable or unnecessary presentations to emergency departments.<sup>3</sup> In many countries,

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The learning health system (LHS) concept is gaining traction in multiple healthcare settings yet remains relatively underexamined in primary care, particularly through the lens of implementation science.

## WHAT THIS STUDY ADDS

⇒ This study uses an established implementation science framework to describe key facilitators and barriers to the cultivation of an LHS in a primary care setting.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ We compare these factors to the small existing body of literature in this area and propose practical solutions to implement the principles of the LHS into primary care practice.

including the UK and Australia, primary care is chiefly provided through general practitioners (GPs).<sup>4,5</sup> However, general practice is under pressure. Ageing populations and an increase in chronic disease have heightened the demand for primary care services.<sup>6,7</sup> Growth in the workforce has flatlined<sup>8,9</sup> with fewer GPs providing care for more people,<sup>10</sup> and many GPs unsure of the viability of their practice.<sup>11</sup> More recently, the unprecedented challenge of a global pandemic has necessitated system-wide reorganisation<sup>12</sup> and placed many additional stresses on GPs and the system in which they work.<sup>13</sup> The solutions to these entrenched implementation issues are by no means easy or short term, but in the interim, general practice needs a viable framework to guide the steps towards a sustainable and high-performing primary care system. In response, the concept of a learning health system (LHS) has been proposed.<sup>14</sup> According to the National Academy of Medicine (NAM; then the Institute of Medicine), an LHS is a system that ‘*consistently delivers reliable performance and constantly improves, systematically and*

*seamlessly, with each care experience—in short, a system with an ability to learn.*<sup>15</sup>

LHSs have been embraced by multiple providers who have reported a variety of benefits, including increases in evidence-based care delivery, improved clinical outcomes, higher levels of patient-centred care and reductions in adverse events.<sup>16</sup> The core characteristics of an LHS identified by the NAM include: (1) science and informatics that provide real-time access to knowledge and digitally capture care delivery; (2) patient–clinician partnerships, where patients are engaged, empowered participants in care; (3) incentives that reward high-value care and transparency; and (4) a continuous learning culture that is supported by the system and its leaders.<sup>17</sup> More recently, a fifth characteristic has been identified, structure and governance, that aligns policy and regulation to facilitate research, collaboration and learning.<sup>18</sup> An LHS can manifest at the micro level of the practice right through to the macro level of the healthcare system. This makes the LHS model well suited for primary care, and able to help support the performance of individual general practices and their interactions with the larger healthcare system. However, despite their promise for primary care, most reports describe LHS in tertiary hospital settings, with few that focus on the unique context of general practice or its providers on the frontlines of care.<sup>19</sup>

Even less frequent in the literature are reports of primary care LHS that are underpinned by principles of implementation science, a field that aims to establish what works and why in the translation of research evidence into practice.<sup>20</sup> The simplicity of the five-part LHS framework is somewhat deceptive; not only are its components multifaceted and their role unpredictable,<sup>21</sup> but they must also be applied in the broader complex adaptive system of healthcare.<sup>22</sup> Subsequently, there are many factors that affect the success of the LHS in the real world. Implementation science frameworks provide an evidence-based explanation of such factors, enabling us to leverage facilitators, and overcome barriers. An established method of doing so is via the theoretical domains framework (TDF), which brings together multiple theories of behaviour change into a single 14-item framework.<sup>23</sup> In the present study, we used the TDF to conduct secondary analysis of data obtained in our previous investigation of an LHS in the general practice setting. We aimed to identify and describe the barriers and facilitators to adopting LHS principles specific to each of the five components of the LHS framework, and to provide evidence-based implementation recommendations for general practices who are making the journey towards an LHS.

## METHODS

This study is a secondary analysis of data generated in a qualitative investigation of an LHS in primary care.<sup>24</sup> Our original investigation brought together researchers from the Australian Institute of Health Innovation (AIHI) and staff from MQ Health General Practice (MQGP)

in a qualitative study that used an embedded research approach and that was codesigned by the research team from AIHI, and clinicians and senior clinic administrators from MQGP.

### Study setting and context

MQGP is a not-for-profit, university-based general practice that operates in the northern suburbs of Sydney, Australia across two sites: one adjacent to a hospital on the university campus, and one in a suburban location.<sup>24</sup> The practice is part of the broader entity of MQ Health, which also comprises specialist clinics, an inpatient hospital, and allied health, medical imaging, radiotherapy and on-site pathology services. Most MQGP staff are employees of MQ Health and have access to educational resources available to employees of Macquarie University. Due to its university affiliation, MQGP is actively involved in research and teaching activities and has a strong record of quality improvement initiatives. MQGP also participates in its local Primary Health Network (PHN), which is a government-initiated, independent organisation that aims to streamline and coordinate primary care services. At the time of the study, MQGP employed 17 GPs, 4 clinic nurses, 13 administrative staff and a clinical psychologist across both sites.

### Embedded research approach

In our embedded research approach,<sup>25</sup> a research assistant from AIHI (GD) was introduced to all MQGP staff at a clinic practice meeting in July 2021, and then worked alongside practice staff until December 2021. The embedded researcher was included on all staff emails, liaised closely with the practice's business manager and GPs and attended the practice's 'strategy day'. The embedded researcher was also involved in the coordination and data collection of the present study.

### Data collection and recruitment

We conducted semistructured interviews with MQGP staff. The research team used the modified five-characteristic NAM LHS framework<sup>18</sup> to design the interview questions, which were then reviewed by multiple clinical and administrative staff at MQGP to ensure their clarity and relevance to the practice. All practice staff were invited to take part in the study via email, where they were provided with participant information and consent forms that outlined the purpose of the research study. There was no sample size calculation for the study. Instead, we aimed to interview a sample that was representative of all clinic staff. Interviews were conducted in October 2021 by a senior research fellow (LE) or the embedded research assistant (GD), either in person at the general practice or via teleconference. The interviewers had prior training in qualitative research methods and interviewing.

### Analysis

Interviews were audio recorded and transcribed verbatim. To deidentify the data, staff were given a unique code that consisted of their role (ADMIN, administrative staff; GP,

**Table 1** Elements of the LHS and TDF frameworks

LHS components	
Science and informatics	Real-time access to knowledge and digital capture of the care experience.
Patient–clinician partnerships	Engaged, empowered patients and families that are full partners in a patient-centred system.
Incentives	Incentives aligned for value that actively encourage ongoing improvement of care and full transparency.
Continuous learning culture	Leadership-instilled culture of learning and supportive system competencies that encourage staff skill development.
Structure and governance	Policies, governance and regulations aligned to facilitate research, collaboration and learning.
TDF determinants	
Knowledge	An awareness of the existence of something.
Skills	An ability or proficiency acquired through practice.
Social and professional roles and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting.
Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use.
Optimism	The confidence that things will happen for the best or that desired goals will be attained.
Beliefs about consequences	Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation.
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a stimulus.
Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way.
Goals	Mental representations of desired outcomes or end states.
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives.
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour.
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours.
Emotion	A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event.
Behavioural regulation	Anything aimed at managing or changing objectively measured actions.
LHS framework adapted from <sup>18</sup> . TDF framework reproduced from <sup>23</sup> under the Creative Commons Attribution 4.0 International License ( <a href="http://creativecommons.org/licenses/by/4.0/">http://creativecommons.org/licenses/by/4.0/</a> )	
LHS, learning health system; TDF, theoretical domains framework.	

general practitioner; NUR, nursing staff) and a random number. Deidentified interview transcripts were imported into NVivo V.20. The secondary analysis of study data was conducted by two members of the research team who were independent of the original study data collection (GF, MS), who conducted a deductive framework analysis<sup>26</sup> with the TDF and LHS framework (the Independent Analysis Team, IAT). The components of each of these frameworks are detailed in [table 1](#).

Both members of the IAT first coded an interview transcript together in real time, categorising the data into the domains of the TDF. Then, the IAT independently coded five transcripts, iteratively checking agreement and discussing conflicts after each. After the fifth transcript, the IAT's mean±SD agreement across all TDF domains was 87.6%±10.1%. The IAT researchers then each independently coded half of the remaining transcripts. Next,

they used the modified five-component NAM LHS framework<sup>18</sup> to organise the data in each TDF determinant; this second deductive process ensured data coded to each TDF determinant were also described in relation to the key tenets of an LHS. Counts of the number of participants who made statements coded to each TDF determinant and each LHS component were recorded. Finally, the IAT researchers met and inductively generated belief statements that were relevant to each domain of the TDF and each component of the LHS. Final results were reviewed for validity by four members of the original study team: two senior academics from AIHI (LE, JB), one GP from MQGP (DF) and the embedded research assistant (GD).

## RESULTS

A total of 32 out of 35 (91%) practice staff were interviewed, which included GPs (n=15), practice nurses

**Table 2** Key TDF determinants and associated belief statements for each domain of the LHS framework

	Key TDF domains		Belief statements	Exemplar quote
Science and informatics	Environmental context and resources	+	MQGP's affiliation with both Macquarie University and the PHN facilitated real-time access to data.	'Through the university we can access to a lot of information that would normally be subscription.' (GP5)
		+	Data associated with COVID-19 tended to be made more rapidly available.	'Take COVID as an example...protocols and guidelines are changing week to week.' (GP1)
	Social and professional roles and identity	~	Different professions had different access to science and informatics.	'I have access to things on the ETG and AMA...those are things that are just available for registrars.' (GP8)
	Knowledge	-	Low knowledge about how to access information prevented engagement with LHS.	'I have no idea what [software] is, which sounds absolutely dreadful. No one's brought it up with me.' (ADMIN13)
	Memory attention and decision processes	-	Use of science and informatics was based around their perceived difficulty or cognitive load.	'[I'm] probably not sure [about using the software]...if it is quite too difficult or if it's, something that would actually take up time.' (ADMIN2)
	Beliefs about consequences	+	Belief that technology would decrease workload and have positive impacts on care facilitated its use.	'I mean [the technology] is definitely useful and how that could be used, would be to recall patients who are falling through the cracks.' (GP2)
Patient-clinician partnerships	Reinforcement	+	Engagement in partnerships was driven by the rewards they provided.	'The way I know whether we're providing a good service is, patient feedback.' (ADMIN1)
	Environmental context and resources	+	Strong and clear leadership and management promoted partnerships.	'[At MQGP]...the doctor, patient, the nurse, and admin staff work as a team, and that is again to empower the patient.' (ADMIN12)
		+	Unique structure of a general practice meant that partnerships were also driven by non-clinical staff.	'Normally—if the patient's happy to—they just tell [the reception staff] then they will communicate it straight to [senior administration staff].' (ADMIN10)
	Professional role and identity	~	Professional role mediated nature of partnerships, for example, administrative staff were unable to give medical advice.	'And that's hard because you, you want to try and help ease their anxiety. But at the same time, you can't give clinical advice.' (ADMIN6)
Beliefs about consequences	+	Positive beliefs about consequences of partnerships facilitated engagement in them.	'There are some patients who...I believe they could definitely add some beautiful insight. Then there are some which would create more chaos.' (ADMIN7)	
Incentives	Reinforcement	+	Engagement with incentives was driven by the rewards they provided, both intrinsic and extrinsic.	'The incentive personally is always to be better so that you can be better for your patients.' (GP2)
	Professional role and identity	~	Professional role mediated access to incentives.	'Within our clinic [for] GPs there are some...incentives in terms of particular indicators based on various things they clinically work on.' (GP3)
	Emotion	-	Perceived inequity in incentives generated negative emotions and was a barrier to engagement.	'Part of the issue is getting the philosophy of what's a proper incentive system...You don't want it to be competing with your colleagues, you actually want it to be collaborative and to be fair.' (GP10)
Continuous learning culture	Environmental context and resources	+	Affiliation with both Macquarie University and the PHN facilitated learning opportunities.	'We enlisted the PHN to run some improvement workshops, and the idea was for it to be team building.' (ADMIN1)
		+	Leadership and management team perpetuated a strong culture of learning.	'We are continuously, like, encouraged to learn information that is relevant to what we do every day.' (ADMIN6)
		+	Distribution of a weekly newsletter facilitated learning.	'We get a newsletter every week [that] updates protocols on a weekly basis. So, we're aware of those changes.' (ADMIN12)
	Professional role and identity	~	Professional role influenced access to, and engagement with, learning opportunities.	'[I have] a lot of different [learning activities] because GPs are always learning.' (GP9)
	Social influences	+	Learning arose from social interactions with colleagues.	'A lot of that comes from a peer saying 'I've discovered'.' (GP10)
	Memory attention and decision processes	+	Clinical staff paid more attention to learning about conditions with which patients presented.	'When you see the patient and you don't know something, then that raises a flag that...I need to read a bit more.' (GP2)
	Beliefs about capabilities	+	Belief of inability to keep up with the pace of information prevented learning.	'There's so much information in there...So, try and find the time to actually update myself is a bit strenuous.' (ADMIN3)

Continued

**Table 2** Continued

	Key TDF domains		Belief statements	Exemplar quote
Structure and governance	Environmental context and resources	-	Complexities and poor communication from Medicare prevented engagement with LHS.	'Trying to find out what those changes were...there was literally nothing until the first of July, when MBS published the fact sheet.' (ADMIN1)
		-	General practice is a low-risk environment, which was a barrier to knowledge of incident reporting processes.	'I think there is an [incident] form...But obviously that's never happened. I don't know where that form is.' (ADMIN10)
	Memory, attention and decision processes	+	Clear practice policies facilitated decision-making.	'Having that sort of delegation of roles makes it easier for us.' (GP5)
	Social influences	+	Colocation facilitated social relationships with other MQ Health clinicians, which mediated organisational engagement.	'With all collaborations or referrals, it's good to know the person, [to whom] you are referring.' (GP2)

- , Mediator. +, Facilitator. -, Barrier.  
ADMIN, administrative staff; GP, general practitioner; LHS, learning health system; MQGP, MQ Health General Practice; PHN, Primary Health Network; TDF, theoretical domains framework.

(n=3), administrative staff (n=13) and a psychologist (n=1). Three clinicians were unable to attend their scheduled interview, and as data saturation was reached, these interviews were not rescheduled. Interviews lasted between 17 and 50 min (mean 35.5). Participating staff had been working at MQGP for between 3 weeks and 15 years.

### Barriers and facilitators to an LHS

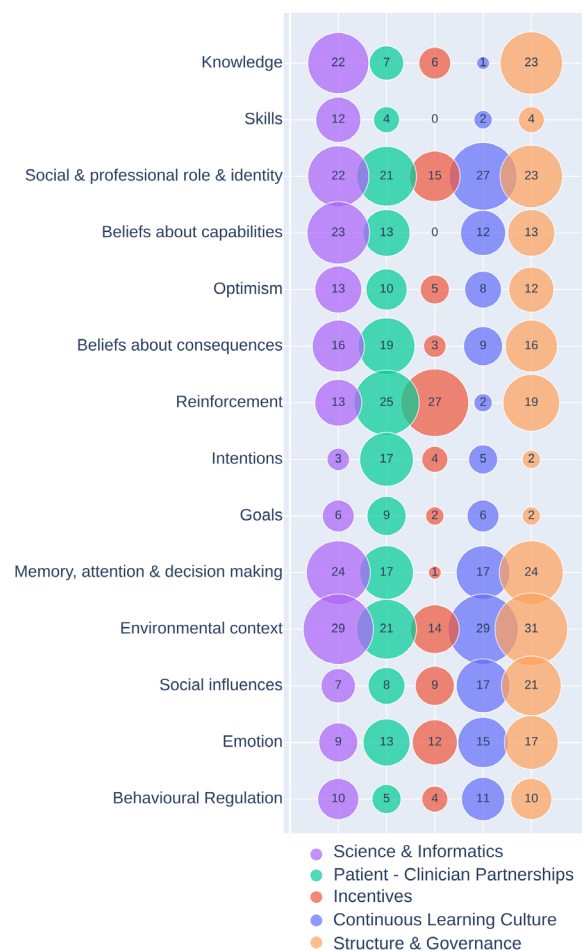
The *environmental context and resources available to participants* and their *social and professional role and identity* were key determinants in engagement with most domains of the LHS. *Reinforcement* was particularly important for the development of patient-clinician partnerships and engagement with incentives in the LHS, while a several domains of the TDF had a reciprocal relationship with the practice structure and governance; for example, clear policy facilitated the development of a strong professional identity, which then in turn facilitated access to and understanding of policy. Key barriers and facilitators that are relevant to each domain of the TDF are reported in table 2, according to each of the five LHS components. Figure 1 provides a visual summary of the framework analysis and the relative proportions of each TDF domain described in each LHS component.

### Data

The codebook and exemplar quotes on which these results were based are available as online supplemental material associated with this manuscript. The full study dataset is available from the authors on reasonable request, subject to ethical approval.

### DISCUSSION

In our original study, we presented a case study of an LHS within an Australian primary care setting and showed that it was operating within several dimensions of the LHS framework, and that its staff were willing to embrace additional elements of the LHS.<sup>24</sup> In this secondary analysis, we used the TDF to describe barriers and facilitators to



**Figure 1** Results from the framework analysis using the learning health system (LHS) and theoretical domains framework (TDF) domains. Each domain of the LHS is represented by a different colour. Each coloured circle represents a TDF determinant. The sizes of the circles represent the number of participants who reported a quote in the respective TDF determinant, which are also written on each circle.

converting this willingness into reality. In all LHS domains there was a consistently reported influence of *environmental context and resources*; for example, the MQGP affiliation with a university was described as a strong facilitator of learning, and the unique general practice environment was reported to shape patient–clinician partnerships. The *professional role* of participants was a second consistently reported determinant, influencing access and attitudes to learning and incentives. The reported impact of other determinants varied across LHS dimensions; for example, continuous learning culture was mediated by *social influences*, where strong social relationships were reported to facilitate informal learning, while a lack of *knowledge* of clinic structure and governance was described as a barrier to its effectiveness. Overall, our results show that implementing the principles of an LHS in this primary care setting was influenced by many behavioural determinants, some applicable to healthcare in general, but most specific to the general practice structure and environment.

A key strength of the study was its codesign, which allowed it to reflect the goals of both the research team and the staff of MQGP. Further strengths included the high participation rate and broad recruitment strategy, which enabled a comprehensive description of behavioural determinants from the perspective of clinical and non-clinical staff. Additionally, this secondary analysis was conducted by an IAT that did not participate in the original study and were thus less subject to biases from their relationships with practice staff or from the original interviews. The primary limitation of this study was the inclusion of only one organisation, limiting the generalisability of our results to other primary care settings. Generalisability is also limited by the affiliation of the practice with a university which, while a facilitator of the uptake of LHS principles, is relatively uncommon in the Australian context. A final limitation was the timing of the present study, which was conducted during and after significant public health restrictions associated with the COVID-19 pandemic. These restrictions, and their removal, would likely have influenced the responses of participants.

Despite these limitations, our results have encouraging similarities with the few other empirical investigations of primary care LHS that are grounded in implementation science.<sup>19</sup> Pestka and colleagues qualitatively evaluated the lessons learnt from their implementation of a primary care LHS in the USA.<sup>27</sup> They, too, reported that clearly defined roles and the incentivisation of value-based care were facilitators to the development of an LHS, as was the use of a weekly newsletter to communicate essential information. However, their investigation took place in a system of 40 primary care practices, much larger than the two practices described in the present study. The facilitatory effect of a weekly newsletter was diluted by a larger LHS size, where at times people had ‘no idea what was going on at other stations’;<sup>27</sup> a finding that was echoed by another investigation of a province-wide primary care LHS in Canada.<sup>28</sup> The same study also reported that the

### Box 1 Summary of five key barriers and facilitators to a learning health system (LHS) in primary care and five proposed solutions.

#### Key barriers

- ⇒ Unclear policy and roles.
- ⇒ Poor data quality.
- ⇒ Complex learning requirements.
- ⇒ Physical distance between teams.
- ⇒ Poor communication with patients.

#### Key facilitators

- ⇒ Strong leadership.
- ⇒ Desire to help patients.
- ⇒ Shared organisational goals.
- ⇒ Culture of patient-centred care.
- ⇒ Communication of progress and goals.

#### Key solutions

- ⇒ Formal lines of patient communication and feedback (eg, online reviews).
- ⇒ Diverse modes of care and communication (eg, telehealth).
- ⇒ Weekly practice newsletter to share updates and progress.
- ⇒ Multidisciplinary leadership teams that model a learning culture.
- ⇒ Mentorship and ‘buddy systems’ between senior and junior staff.

Each point describes a barrier, facilitator or solution described in at least two of the three following papers: (a) Nash *et al.*,<sup>28</sup> (b) Pestka *et al.*<sup>27</sup> or (c) current study.

perceived difficulty or cognitive load of a technology was a primary barrier to its use, and that a perceived increase in the quality and efficiency of patient care was a motivation for participants to engage in the LHS,<sup>28</sup> findings similar to our results. However, a key difference between their investigation and our own was the *type* of incentives that motivated participants; in the Canadian province-wide primary care LHS competition or peer pressure were motivators for engagement,<sup>28</sup> while our participants reflected that they were primarily motivated by the rewards of providing better patient care and developing a sense of comradery with their colleagues. These differences may reflect the different social contexts in which the studies were conducted, particularly the influence of the COVID-19 pandemic, in which healthcare workers likely banded together to deal with high levels of uncertainty and stress.

The results of our own and other empirical investigations suggest that while some barriers and facilitators are unique to certain contexts, others are common to many journeys towards a primary care LHS. These are summarised in **box 1**, which also describes possible strategies for primary care practices to facilitate their journey towards an LHS. A notable facilitator that likely applies to all contexts is *external support*, as many primary care providers work in small independent community practices which limits their access to resources.<sup>29</sup> Affiliations with academic and professional institutions, including the use of codesign and embedded researchers, or collaborations of multiple primary care practices are viable

strategies that cultivate a primary care LHS. Additionally, our results suggest that it is not only patient–*clinician* partnerships that are important in the primary care LHS, but rather that administrative staff also play an important role in the patient experience. As such, primary care practices that aim to become LHS should invest in training, involvement and retention of all staff, not just those in clinical roles.

## CONCLUSION

There are numerous benefits, success factors and barriers in primary care settings making the transition to LHS. These factors should feed into a roadmap to assist primary care settings that are at different stages of the journey towards an LHS.

**Acknowledgements** The authors gratefully acknowledged all interview participants who kindly gave their time to partake in this research.

**Contributors** JB, SW, JM, GD, KC and LE conceptualised the study. GD and LE collected the data. GF and MS analysed the data with input from LE and GD. GF created the study figures with input from MS, LE and JB. GF drafted the manuscript. JB is guarantor.

**Funding** JB is funded by multiple grants including the National Health and Medical Research Council (NHMRC) Partnership Grant for Health Systems Sustainability (ID: 9100002) and NHMRC Investigator Grant (ID: 1176620) on the learning health system and its applications.

**Disclaimer** The funders had no role in the design, analysis, and interpretation of the research, or drafting of the manuscript.

**Competing interests** None declared.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by Macquarie University Human Research Ethics Committee (reference number: 52021905624229). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

## ORCID iD

Georgia Fisher <http://orcid.org/0000-0002-7252-7800>

## REFERENCES

- 1 Australian Institute of Health and Welfare. Primary health care in Australia. Australian Institute of Health and Welfare; Canberra (AU), 2016. Available: <https://www.aihw.gov.au/reports/primary-health-care/primary-health-care-in-australia/contents/about-primary-health-care> [Accessed 4 Aug 2023].
- 2 NHS England. London (ENG): NHS England. Primary care services, Available: <https://www.england.nhs.uk/get-involved/get-involved/how/primarycare/> [Accessed 4 Aug 2023].
- 3 Dolton P, Pathania V. Can increased primary care access reduce demand for emergency care? evidence from England's 7-day GP opening. *J Health Econ* 2016;49:193–208.
- 4 Australian Institute of Health and Welfare. General practice, Allied health and other primary care services. Australian Institute of Health and Welfare; Canberra (AU), 2023. Available: <https://www.aihw.gov.au/reports/primary-health-care/general-practice-allied-health-and-other-primary-c> [Accessed 4 Aug 2023].
- 5 NHS England. NHS England; London (ENG), 4 August 2023. Available: <https://www.england.nhs.uk/five-year-forward-view/next-steps-on-the-nhs-five-year-forward-view/primary-care/>
- 6 Australian Institute of Health and Welfare. Ageing and the health system: challenges, opportunities and adaptations. Australian Institute of Health and Welfare; Canberra (AU), 2014. Available: [https://www.aihw.gov.au/getmedia/19dbc591-b1ef-4485-80ce-029ff66d6930/6\\_9-health-ageing.pdf.aspx](https://www.aihw.gov.au/getmedia/19dbc591-b1ef-4485-80ce-029ff66d6930/6_9-health-ageing.pdf.aspx) [Accessed 4 Aug 2023].
- 7 Raymond A, Bazeer N, Barclay C, *et al*. Our Ageing Population: How Ageing Affects Health and Care Need in England. London: The Health Foundation, 2021.
- 8 Royal Australian College of General Practitioners. Australia; General Practice: Health of the Nation 2021, 2021. Available: <https://www.racgp.org.au/health-of-the-nation/chapter-2-general-practice-access/2-2-gp-workforce>
- 9 Osborne S. One in seven GP posts empty as vacancy rates remain high: pulse. 2021. Available: <https://www.pulsetoday.co.uk/news/workforce/one-in-seven-gp-posts-empty-as-vacancy-rates-remain-high>
- 10 Pressures in general practice data analysis: British Medical Association, 2023. Available: <https://www.bma.org.uk/advice-and-support/nhs-delivery-and-workforce/pressures/pressures-in-general-practice-data-analysis>
- 11 Royal Australian College of General Practitioners. Australia; General Practice: Health of the Nation 2022, 2022. Available: <https://www.racgp.org.au/general-practice-health-of-the-nation-2022/>
- 12 Joy M, McGagh D, Jones N, *et al*. Reorganisation of primary care for older adults during COVID-19: a cross-sectional database study in the UK. *Br J Gen Pract* 2020;70:e540–7.
- 13 Jefferson L, Golder S, Heathcote C, *et al*. GP wellbeing during the COVID-19 pandemic: a systematic review. *Br J Gen Pract* 2022;72:e325–33.
- 14 Foo D, Mahadeva J, Lopez F, *et al*. High-performing primary care: Reinvigorating general practice as a learning health system. *Br J Gen Pract* 2023;73:8–9.
- 15 Smith M, Halvorson G, Kaplan G. What's needed is a health care system that learns: recommendations from an IOM report. *J Am Med Assoc* 2012;308:1637–8.
- 16 Enticott J, Johnson A, Teede H. Learning health systems using data to drive Healthcare improvement and impact: a systematic review. *BMC Health Serv Res* 2021;21:200.
- 17 Olsen L, Aisner D, McGinnis JM, eds. Institute of medicine (US) Roundtable on evidence-based medicine. In: *The Learning Healthcare System: Workshop Summary*. Washington (DC): National Academies Press (US), 2007.
- 18 Zurynski Y, Smith CL, Vedovi A, *et al*. Mapping the learning health system: a Scoping review of current evidence. Sydney: Australian Institute of Health Innovation and the NHMRC Partnership Centre for Health System Sustainability, 2020.
- 19 Nash DM, Bhimani Z, Rayner J, *et al*. Learning health systems in primary care: a systematic Scoping review. *BMC Fam Pract* 2021;22:126.
- 20 Bauer MS, Kirchner J. Implementation science: what is it and why should I care. *Psychiatry Res* 2020;283:112376.
- 21 De Bruin J, Bos C, Struijs JN, *et al*. Conceptualizing learning health systems: A mapping review. *Learn Health Syst* 2023;7:e10311.
- 22 Braithwaite J. Changing how we think about Healthcare improvement. *BMJ* 2018;k2014.
- 23 Atkins L, Francis J, Islam R, *et al*. A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implement Sci* 2017;12:77.
- 24 Dammery G, Ellis LA, Churruca K, *et al*. The journey to a learning health system in primary care: a qualitative case study Utilising an embedded research approach. *BMC Prim Care* 2023;24:22.
- 25 Churruca K, Ludlow K, Taylor N, *et al*. The time has come: embedded implementation research for health care improvement. *J Eval Clin Pract* 2019;25:373–80.
- 26 Gale NK, Heath G, Cameron E, *et al*. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117:1–8:.



- 27 Pestka DL, White KM, DeRoche KK, *et al.* Trying to fly the plane while we were building it'. applying a learning health systems approach to evaluate early-stage barriers and Facilitators to implementing primary care transformation: a qualitative study. *BMJ Open* 2022;12:e053209.
- 28 Nash DM, Brown JB, Thorpe C, *et al.* The Alliance for healthier communities as a learning health system for primary care: A qualitative analysis in Ontario, Canada. *J Eval Clin Pract* 2022;28:1106–12.
- 29 Ministry of health and long-term care and eHealth Ontario. electronic health records. In: *Implementation Status Ontario (CA)*. Ontario (CA): Ministry of Health and Long-Term Care and eHealth Ontario, 2016. Available: [https://www.auditor.on.ca/en/content/annualreports/arreports/en16/v1\\_303en16.pdf](https://www.auditor.on.ca/en/content/annualreports/arreports/en16/v1_303en16.pdf) [accessed 4 Aug 2023].