






ORIGINAL ARTICLE

Navigating the application of new innovations: Establishing an indocyanine green lymphography clinic in Australia

Megan Trevethan BOccThy^{1,2}  | Sally Bennett PhD, BOccThy (hons)²  |
Emmah Doig PhD, BOccThy (hons)³  | Freyr Patterson PhD, BOccThy, MPH²  |
Amanda Pigott PhD, BOccThy^{1,2} 

¹Occupational Therapy Department, Princess Alexandra Hospital, Brisbane, QLD, Australia

²The University of Queensland, Brisbane, QLD, Australia

³Surgical Treatment and Rehabilitation Service (STARS) Research and Education Alliance, The University of Queensland and Metro North Health Service, Brisbane, QLD, Australia

Correspondence

Megan Trevethan, Occupational Therapy, Princess Alexandra Hospital, 199 Ipswich Road, Woolloongabba QLD 4102, Australia.
Email: megan.trevethan@health.qld.gov.au

Abstract

Translation of evidence into practice in healthcare is challenging, particularly with new innovations. Indocyanine Green (ICG) lymphography is a novel innovation where the superficial lymphatics are imaged to provide information about lymphoedema diagnosis and to guide individualised therapy for a person's long-term chronic management of lymphoedema, supporting care across the continuum to the community setting. Despite the unique information ICG lymphography provides, the technology itself is complex and highly specialised and currently has limited adoption in clinical practice. This paper sought to determine the barriers and enablers to establishing an ICG lymphography clinic within an outpatient lymphoedema service by exploring staff perceptions and experiences. An interpretive descriptive design was used with semi-structured interviews of key staff participants from a quaternary public hospital six months after ICG lymphography clinic establishment. An interview guide was developed, underpinned by the Consolidated Framework for Implementation Research (CFIR), to guide the inquiry. Interview data were transcribed, inductively coded and analysed to identify themes. All eligible management, clinical and ancillary staff were included ($N = 8$). Four key themes were identified from the data as essential to implementation success. These were *support is critical for implementation; beliefs about the technology; practicalities are achievable; and sustainability for ongoing success*. Themes were found to be interrelated and centred around support from staff and the organisation as a critical process facilitator. The study demonstrated an ICG lymphography clinic can be successfully established as part of an outpatient lymphoedema service. Key enablers related to positive staff attitudes and beliefs about ICG lymphography and its application. Future implementation sites may consider that although the complexity of this innovation creates process challenges, the use of an implementation framework can assist in identifying determinants of success for effective implementation to practice.

KEYWORDS

chronic disease management, delivery of health care, diffusion of innovation, health services, indocyanine green, lymphoedema, lymphography, technology

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. *Health and Social Care in the Community* published by John Wiley & Sons Ltd.

1 | INTRODUCTION

Translation of evidence into practice is acknowledged as a challenge in healthcare (Wensing & Grol, 2019). Implementation Science has shown evidence-practice gaps due to interventions not being readily translated into practice (Demiris, Parker Oliver, Capurro, & Wittenberg-Lyles, 2014) or when significant time is taken to embed practice change (Demiris et al., 2014; Thornicroft, Lempp, & Tansella, 2011). Uptake of promising innovations can be compounded by challenges of an evolving evidence base (Atkins & Kupersmith, 2010; Glasgow & Emmons, 2007). Indocyanine Green (ICG) lymphography is a novel imaging technology with the potential to guide chronic lymphoedema diagnosis, staging and treatment planning. However, despite its recognised benefits, ICG lymphography has not been widely established in routine lymphoedema practice.

Cancer-related lymphoedema is the chronic swelling of a body part resulting from change to an individual's lymphatic function. Lymphoedema affects one in seven people treated for cancer (Rockson, Keeley, Kilbreath, Szuba, & Towers, 2019) and is often life-long, requiring chronic disease management in partnership with specialist and primary healthcare. Lymphoedema can impact participation in meaningful activities, psychosocial wellbeing and quality of life (Grada & Phillips, 2017; Koelmeyer et al., 2019). ICG lymphography involves the injection of ICG dye intradermally in the affected limb and the use of a near-infrared camera to observe the dye fluorescence as it travels through the superficial lymphatics (see Figure 1) (Suami, 2012). ICG lymphography provides a roadmap for a person's working superficial lymphatics and offers a foundation for individualised lymphoedema therapy planning for effective long-term self-management.

Traditional lymphoedema diagnosis, staging and therapy planning have been predominantly based on clinical assessment comprised of

What is known about this topic?

- ICG lymphography is a novel imaging technique that is not yet routinely used in clinical practice.
- ICG lymphography has the potential to transform self-management for people with chronic lymphoedema.
- Translation of innovations like ICG lymphography into routine practice in healthcare is challenging.

What this paper adds

- An ICG lymphography clinic can be successfully implemented in the outpatient setting to support self-management of chronic lymphoedema.
- The Consolidated Framework for Implementation Research is a valuable tool for evaluating translation of new innovations to practice and identifying determinants of success.
- Implementation barriers are seen as surmountable by staff when they hold positive beliefs about the innovation and its impact.

physical observations by an experienced practitioner and a detailed medical history (Dylke et al., 2016). Imaging the lymphatic system is one way to obtain specific individualised information about the lymphatic system to inform lymphoedema therapy. Potential imaging technologies include ICG lymphography, magnetic resonance imaging (MRI), lymphoscintigraphy, and computed tomography (CT). Previous studies have shown ICG lymphography provides increased specificity and detail in lymphatic imaging compared with other imaging technologies (Akita et al., 2016; Mihara et al., 2012; Suami, Koelmeyer, Mackie, & Boyages, 2018) and superior capability for

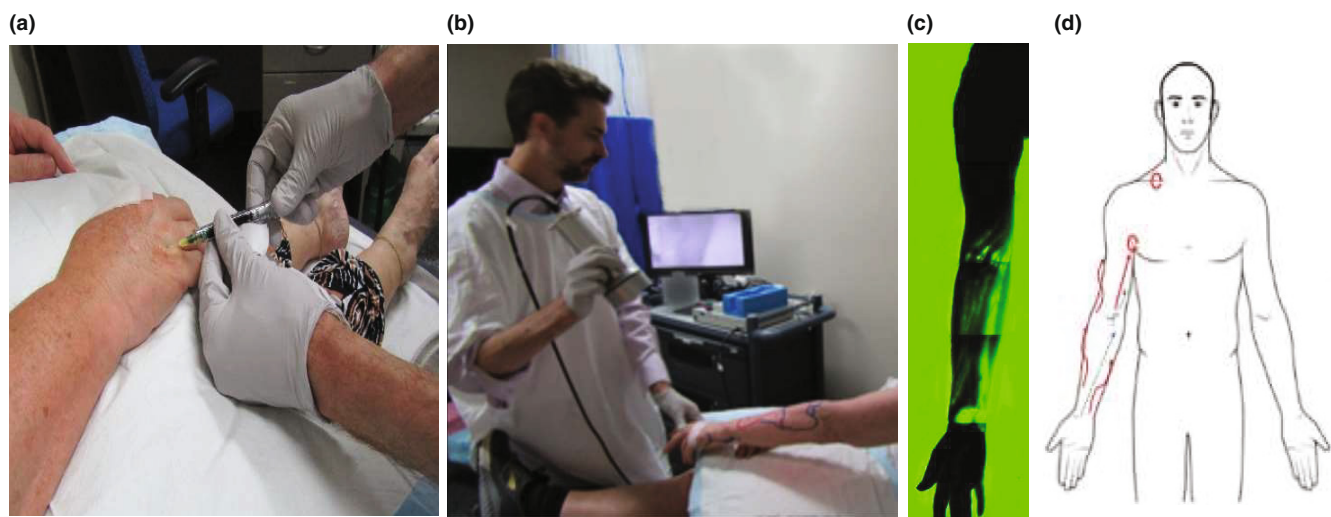


FIGURE 1 ICG lymphography procedure. a) Indocyanine Green (ICG) dye solution is injected intradermally in the target location; (b) Near infrared camera is used to visualise dye fluorescence within superficial lymphatics; (c) compilation image of camera view; (d) body map of modified manual lymphatic drainage pathway for imaging report.

early lymphoedema detection (Thomis et al., 2022). In addition to evidence for its diagnostic benefits, there is growing support for the potential of ICG lymphography to transform therapy planning for people with lymphoedema. Early research using ICG lymphography demonstrates areas of lymphatic impairment do not follow previously assumed drainage patterns and therefore a person's prescribed therapy program can be altered based on more specific and accurate information gained using ICG lymphography (Chang, Suami, & Skoracki, 2013; Koelmeyer et al., 2020). Additionally, patients have reported its benefit to understanding their chronic disease and self-management (Pigott, Doig, McCann, & Trevethan, 2021). However, the introduction of ICG lymphography as part of routine lymphoedema management has been slow, suggesting further investigation is required to determine how best to implement this technology into practice.

The multi-component technology of ICG lymphography has several aspects which create challenges for practice adoption. Implementation frameworks provide a useful guide to consider potential determinants of translation of innovations into practice (Atkins & Kupersmith, 2010). Selecting a suitable implementation framework depends on its intended purpose and timing of use, along with resource availability and project scope (Lynch et al., 2018). The Consolidated Framework for Implementation Research (CFIR), an amalgamation of published theories and frameworks into one consolidated framework to guide implementation research (Damschroder et al., 2009), can be used to proactively explore factors influencing implementation beyond the innovation alone (Damschroder et al., 2009; Kirk et al., 2016). ICG lymphography is a complex procedure in itself and numerous factors may influence its implementation. For example, ICG lymphography requires specialised technology and equipment (e.g., ICG dye and a near-infrared camera), and a sufficiently skilled workforce to enable service delivery. There is limited published evidence detailing the determinants of successful ICG lymphography practice implementation. In Australia, Boyages et al. (2020) included ICG lymphography in their Australian Lymphoedema Education Research and Treatment (ALERT) program. Within their private clinic, ICG lymphography formed an integral component of lymphoedema assessment and treatment planning; however, the components and materials necessary for practice application have not been described.

Despite the aforementioned benefits of ICG lymphography in diagnosis and staging (Akita et al., 2016; Jørgensen, Hermann, Madsen, Christensen, & Sørensen, 2021; Thomis et al., 2022), and potential to impact therapy planning (Koelmeyer et al., 2020; Pigott et al., 2021), there is no available research which explores the determinants of successful application of ICG lymphography in a lymphoedema service in the public health care system. This study aimed to explore the barriers and enablers influencing the application of ICG lymphography within an existing public outpatient cancer-related lymphoedema service through exploration of staff perceptions and experiences of establishing the ICG clinic.

2 | METHODS

2.1 | Research design

This study employed an interpretive descriptive design (Thorne, Kirkham, & Macdonald-Emes, 1997) to explore staff perceptions and experiences of establishing the clinic. The exploration of themes was grounded in the shared experience of participants and the qualitative inquiry acknowledged the value of the researchers' experience in interpreting the responses (Thorne, 2016). The CFIR (Damschroder et al., 2009) was used to underpin the study methods to guide the inquiry of the translation of innovation to practice (Peters, Adam, Alonge, Agyepong, & Tran, 2013).

This research was part of a larger study, with human research ethics approval, evaluating outcomes of ICG lymphography in lymphoedema therapy. Ethical approval was provided by the Metro South Hospital and Health Service Human Research Ethics Committee (HREC/2019/QMS/49709).

2.2 | Implementation setting and process

The setting was an outpatient, multidisciplinary cancer-related lymphoedema service of a quaternary public health facility in Queensland, Australia. Patients were assessed in a lymphoedema assessment clinic by a vascular medicine doctor and specialist lymphoedema occupational therapist to determine lymphoedema diagnosis and prescribe a therapy plan. Subsequent therapy could include periods of intensive treatment with daily bandaging and massage, along with a long-term self-management program often including compression, skin care and self-lymphatic drainage. An ICG lymphography clinic was piloted in 2018 within this existing setting.

Prior to ICG lymphography clinic commencement, an implementation process was undertaken to establish the clinic. This process included staff knowledge and capacity building, establishing infrastructure, equipment acquisition and workflow development with local governance approval (see Figure 2). A consumer partner provided input to the clinic design, procedure experience and research processes. This included feedback following their direct experience of piloting the ICG lymphography procedure and workflows, as well as consultation on supporting resources and formulation of research questions.

Following establishment, the ICG lymphography clinic had a 12-month pilot operation supported by local grant funding. Patients of the existing outpatient therapy service were referred for imaging. The clinic operated for up to 4 h per fortnight and was staffed by a vascular medicine consultant responsible for dye prescription and injection, in conjunction with an occupational therapist specialising in lymphoedema who assisted the remainder of the procedure, with administration officer support. Procedure results and education were incorporated in a subsequent routine lymphoedema therapy review. Over the pilot period of operation, 25 patients underwent ICG lymphography (see Table 1).

FIGURE 2 Process for service establishment.

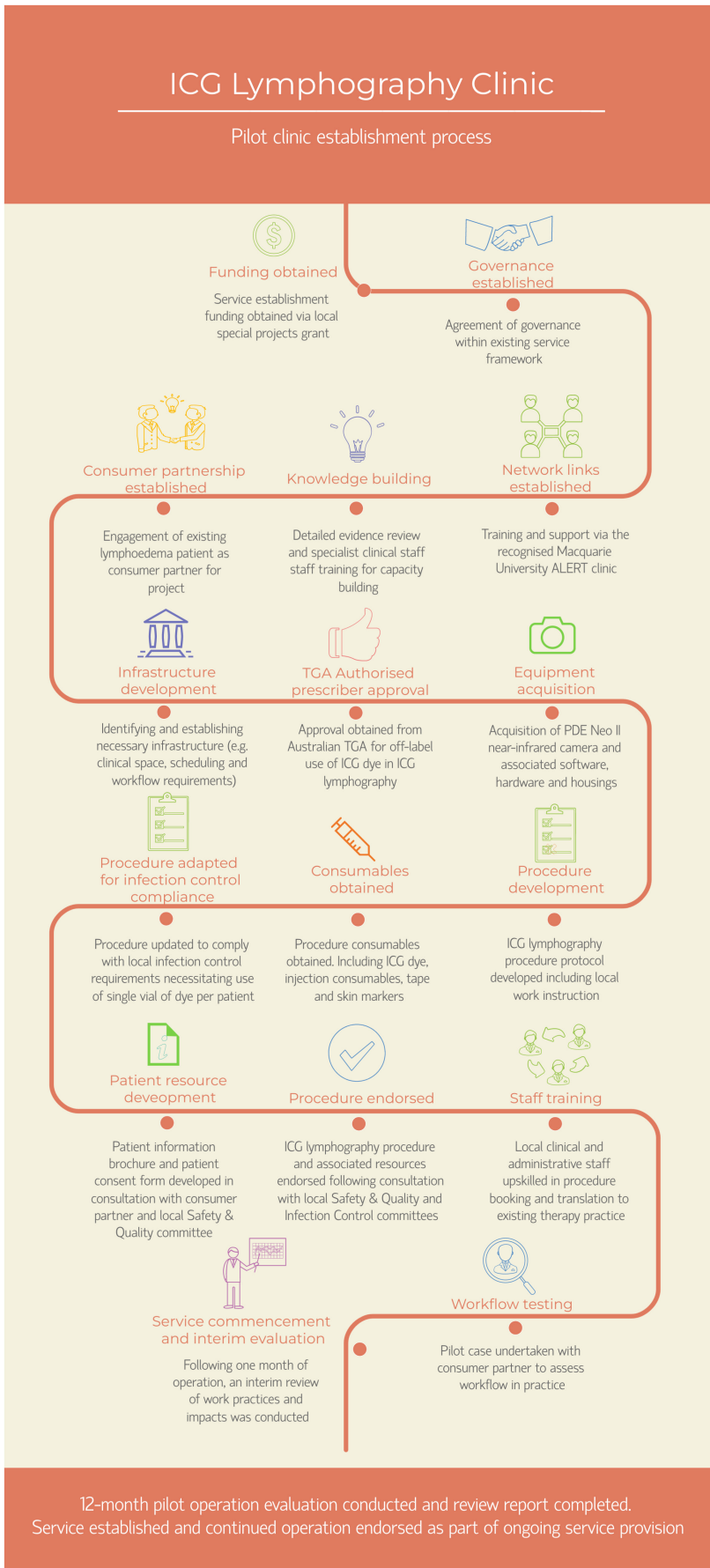


TABLE 1 Service data from patients who underwent ICG lymphography during pilot implementation

	Number (%)
Patient demographics	
Gender	
Female	16 (64)
Age in years (range)	57 (36–78)
Cancer diagnosis	
Breast	8 (32)
Melanoma	13 (52)
Other ^a	4 (16)
Lymphoedema affected limb	
Upper limb	19 (76)
Lower limb ^b	6 (24)
Service data	
Total clinics	16
Patients imaged	25
Referral source	
Newly assessed	5 (80)
Existing	20 (20)
Appointment duration	
Mean time in min (SD)	93.32 (SD 26.856)
Procedure duration	
Mean time in min (SD)	56.4 (SD 11.6555)

^aHodgkin's lymphoma, metastatic BCC, cervical cancer.

^bIncludes one participant with bilateral lower limb lymphoedema.

2.3 | Participants

Convenience sampling was used to identify key staff participants (Bradshaw, Atkinson, & Doody, 2017) who were involved in or affected by the clinic implementation. Due to the specialised nature of the service, eligible participants were eight staff, including a group of managers, clinicians and ancillary staff (i.e., therapy assistant and administration).

2.4 | Data collection and procedures

Semi-structured interviews were conducted six months after the ICG lymphography clinic commenced to explore staff perspectives (Bradshaw et al., 2017). A research assistant who was experienced in qualitative research, with no clinical service or research affiliation at the time, conducted all participant interviews and correspondence. Eligible staff were invited to participate via email and all provided written informed consent.

An interview guide was developed, underpinned by the CFIR (see Appendix S1) (Damschroder et al., 2009). The CFIR consists of five key domains and their associated constructs, including the characteristics of the intervention; the outer setting and inner setting of the organisation; characteristics of the individuals involved; and

the implementation process itself. The CFIR constructs were used to guide interview design with questions covering participant's affiliation with the clinic, knowledge of ICG lymphography, beliefs about the support for ICG lymphography, and relative advantage of local application. Barriers and enablers to local implementation and strategies for sustainability were also explored.

Interviews were conducted via telephone, recorded and transcribed verbatim. Field notes were taken by the research assistant during the interviews. Interview transcripts were reviewed by the principal investigator, a combined summary of responses was collated and sent by email to participants by the research assistant for member checking, with opportunity to provide corrections or additional responses (Birt, Scott, Cavers, Campbell, & Walter, 2016; Thomas, 2017).

2.5 | Data analysis

Qualitative interview data were analysed inductively using thematic analysis (Braun & Clarke, 2006). An inductive analysis approach was taken to ensure data were assigned to categories without the influence of a predetermined structure. This was particularly important given the use of the CFIR in the study design. Data from one transcript were independently coded by two investigators [MT, SB] (one of whom had worked in the clinic), with a third available [FP] as mediator where consensus was not met. A coding tree was developed and agreed upon by all three investigators. The remaining transcripts were coded by investigators [MT and SB]. NVivo software was used to organise the data. Data coding was reviewed at a further three timepoints to improve rigour. Codes were grouped into broad categories by MT in close consultation with co-authors [SB, AP, FP]. Categories were considered individually and as a whole, including interrelationships between ideas.

2.6 | Rigour

Techniques used to improve rigour included the use of a research assistant who was independent to the research and clinical team at the time of interviews; participant member checking of accuracy and representativeness of interpretation of data; and regular research team meetings to ensure consensus throughout data analysis. In terms of reflexivity, particular consideration was given to the potential influence of the primary investigator as an 'insider researcher' on the analysis (Dwyer & Buckle, 2009; Fleming, 2018). To counter this, other research team members [SB and FP], who were not involved in the delivery of the lymphoedema service, supported data interrogation.

3 | FINDINGS

All eligible staff ($n = 8$) consented to participate, including two managers, three clinical and three ancillary staff. Managers included clinical and governance managers, clinical staff varied from senior

therapy clinicians to consultant medical staff, and ancillary staff included an occupational therapy assistant and administrative staff.

Four key interrelated themes were identified and considered essential to implementation success (Figure 3). Implementation success encompassed the operational staffing, resourcing and continued provision of the clinic within the existing lymphoedema service. Of the four themes identified, "Support is critical for implementation success" was central. This "support" was multi-faceted with interconnected relationships between subthemes of staff perspectives, funding support and support of the organisation. The theme "Belief about the technology" captured a range of beliefs staff expressed about the technology itself, its impact and importance to the service, and was a driver of perspectives of key staff. The theme "Practicalities are achievable" highlighted the perceived importance of the intervention characteristics and practical components of the implementation process as being achievable and supported in the setting. The final theme "Sustainability for ongoing success" included necessary factors for sustained implementation over time and was directly influenced by the practicalities and support for implementation.

3.1 | Support is critical for implementation success

The first theme, "Support is critical for implementation success", highlighted that 'support' for the innovation itself, along with its

implementation to practice, was seen as essential by key staff at all levels (management, clinical and ancillary) for overall implementation success. Support was described in the subthemes of financial support for the service, alliance with the organisational culture and the perspectives of key staff. The establishment grant funding support was seen as "instrumental in allowing it to happen" [P4].

Organisational culture and alignment of the project with local organisational priorities and values was viewed as an essential support element. In this setting, the high value placed by the organisation on innovation, research and patient-centred care were seen as enablers to implementation, particularly by clinical and management staff, for example,

"I think, certainly as an occupational therapy department, there is a strong focus on research and innovation. So, I think from that perspective there certainly was an importance placed on [the clinic]...when our whole health service is moving towards, you know, patient-centred care and certainly if the research attached shows positive effects as well... that's an enabler as well..." [P1].

Despite the affiliation of the innovation features with the organisational values, the impact of competing priorities and organisational change at the time of implementation was noted as a challenge by

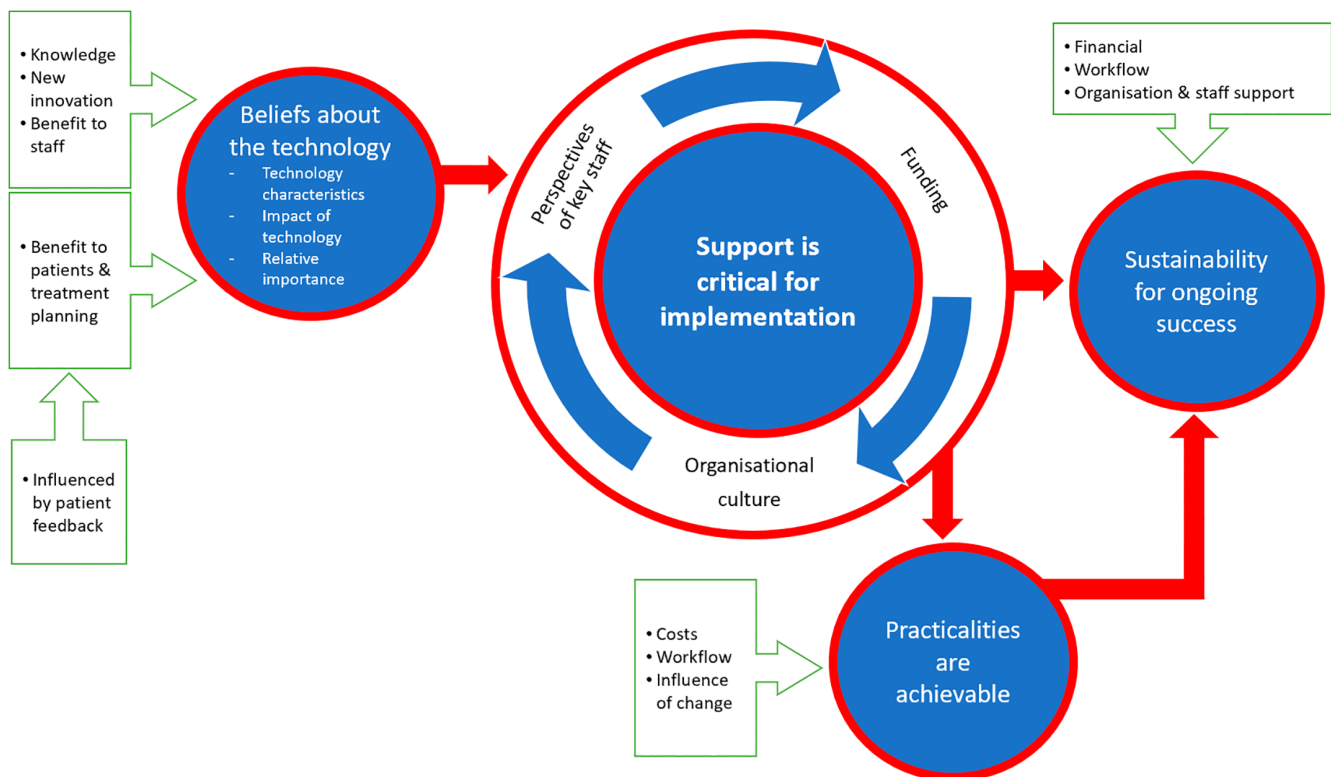


FIGURE 3 Diagrammatic representation of themes.

The four major themes identified as essential for implementation: Support is critical for implementation; Beliefs about the technology; Practicalities are achievable; and Sustainability for ongoing success. Subthemes are linked to the associated primary theme, with relationships identified by directional arrows.

some staff. Change at an organisational level, within the clinical division and therapy department were identified as impacting the implementation by some participants, who explained: "I think there was a lot of different service changes that probably meant it wasn't given as much attention from the surrounding group as it probably would have gotten if it had of happened 12 months prior" [P3]. While other participants at various levels were either unaware of organisational change or felt there was no impact from the change, noting "the project was seen as important by the service and by the department, and was supported as such" [P8].

The support of key staff and those staff perceived as influential was another crucial factor for implementation success. Participants consistently identified support of those in leadership roles (such as executive and departmental directors, and team leaders), along with clinical experts (such as medical consultant and specialist therapists) as imperative. Positive opinions and perspectives of key staff were reported by participants to be important in increasing staff engagement and support in continuing the processes for establishing the clinic. One participant noted "supporting the clinic to get up and running in the first place shows there's a degree of endorsement there" and "[there was] some creative thinking about staffing and how this [clinic] could be accommodated in the team" [P1]. While another noted "I felt that the program has been supported and that it is important...[the divisional chair] is very supportive of the project and continuing this project in an ongoing way" [P8]. Individual perspectives of the implementation including staff knowledge of the innovation, attitudes and feelings of inclusion in the implementation process, and perceived benefit to the individual also influenced their engagement. Clinical staff highlighted an ease of on-boarding new staff, with one staff member explaining "We were quite receptive to being involved in that, I guess it's a new learning experience for us and [we] could also see that it was only going to have a positive effect for patients to be involved in that. So, I think in terms of on boarding the staff in the service, that wasn't too much of a challenge" [P1]. Others described how the timing of their involvement and competing demands presented a challenge to engaging staff in the process "when [staff] passion isn't immediately there, it's really hard for people to jump in on that, particularly if they then have like a number of other things going on as well" [P3]. The support of key staff was also greatly influenced by their beliefs about the technology.

3.2 | Beliefs about the technology

The second theme 'staff beliefs about the technology' highlighted how staff beliefs influenced their perspectives, engagement in implementation, and support afforded, which was an essential enabler of implementation. Beliefs centred around the technology characteristics and what staff understood the technology's benefit or potential to be.

Staff knowledge of the technology influenced their opinion of its potential benefit (and challenges) in application to the clinical setting. Staff at all levels had at least a basic understanding of the

technology and its purpose, with clinical staff providing more detailed descriptions of the procedure and its application to practice. Despite reporting varied levels of technical knowledge, all participants were positive about the value of the innovation, including the opportunity it provided to revolutionise patient-centred care in lymphoedema, its potential to increase staff knowledge in lymphoedema treatment planning and its research potential. For example, participants highlighted "it's a new technology and we can learn a lot in relation to individual's lymphatics systems and there's not really anything else out there from a lymphoedema point of view that we can do that with. I think having the opportunity in the [service] to use that technology, we are really, really lucky and so it's pretty important" [P7] and "there was an amazing appreciation of the technology and what it could do for patients" [P3]. However, some participants also noted its time intensity, the difficulty of such a 'technical technique', and the additional challenge that brings in terms of implementation infrastructure and service sustainability. Here, one participant noted "there was probably some concern around adding another layer of technology into a clinical area that's already quite heavy in the technical aspects" [P3].

All participants believed the benefit of ICG lymphography for patients was substantial and supported implementation of the approach. Participants reported that the experience of and information patients obtained from ICG lymphography to be a powerful motivator, providing increased patient understanding and motivation to engage in self-management.

"I guess one thing that I have really noticed is just how much value the patients have received from just understanding their condition and then the flow on effects from that of course is then how engaged they are in their treatment once they have that understanding and know what's happening for them specifically rather than, you know, theoretically, or anatomically what "should be" happening...and I think that then flows on into the degree of compliance they have as well with the therapy program." [P1].

The benefits perceived by participants also extended to the degree of individualised treatment afforded to patients. Participants explained how the information gained from the procedure enabled tailored therapy planning and guided their decision making in treatment planning.

"I probably didn't realise the clinical effect that was going to have, like, on the ground with patients that we're seeing day to day... in terms of how they do their massage or, you know, what we think about for compression, and those sorts of things" [P1] and "it helps the clinicians in terms of [the] determination of treatment regimes and ultimately better outcomes in terms of lymphoedema management. ... and so will get a better outcome for the patient hopefully, with less impact on the patient because there is some clarity

around the pathway, the lymphoedema/lymphatics and how to prescribe that treatment" [P8].

Many participants reported their beliefs about the impact of ICG lymphography were shaped by hearing positive feedback directly from patients or indirectly from other staff recounting positive patient feedback about the impact. As one participant explained: "overwhelmingly, from my perspective and from the patients that I've engaged with, it's been hugely positive" [P1]. Some staff without any direct clinical contact did not note any specific patient feedback but acknowledged a general willingness of patients to attend the service and no specific service process challenges.

3.3 | Practicalities are achievable

The third theme, 'Practicalities are achievable', staff described a number of practical elements that were necessary components to its successful implementation, including developing the clinical workflow, building clinic infrastructure, and associated funding requirements. Aspects of the workflow were seen as easily integrated by some of those performing the work, particularly ancillary staff who noted "It was quite easy to manage...we all use the existing applications that we had... I didn't really find any issues" [P5]. Building the clinical service infrastructure included acquisition of the necessary physical resources and assigning workforce staffing. Obtaining consumables was described as "no [challenges] from my end. Generally, the suppliers supply the stock pretty quickly" [P2]. While other clinical and management staff noted a balance was required in prioritising ICG lymphography while reducing other aspects of service provision to allow reallocation of staff, and challenges in managing the demand and equity of access for patients. Building and maintaining a skilled workforce for the clinic was seen as an important factor, and staffing changes that occurred around the time of implementation were acknowledged by some as a barrier to implementation. For example, one participant said: "I think it was probably the staffing changes that had the biggest challenge with it because I think if those people had have been on the ground at the time it would've been an easier implementation" [P3].

Most staff also noted cost as a significant factor, including predictability of costs, actual costs and staying within budget. Predicting costs was a challenge, particularly with consumable usage increasing to meet the local infection control requirements of a single ICG vial per patient. One participant explained "[it is possible to] use one vial to make up several syringes for different patients but that's not possible with our infection control procedures here. So that does affect the cost and the number of patients you can treat" [P4]. Most participants indicated that cost, and funding support was one of the likely factors influencing the long-term sustainability of the clinic.

3.4 | Sustainability for ongoing success

The fourth theme described 'Sustainability for ongoing success', with future proofing seen as necessary for long term implementation

success. Factors influencing sustainability included financial sustainability, workflow sustainability and sustained support of key people and the organisation to continue to prioritise the service over time. For example, one participant said: "I guess that would be a barrier if there's no more funds to go into the project" [P6]. Cost-benefit was highlighted as a gap in future implementation planning although there was acknowledgment of the challenges in measuring this. Many staff predicted a cost-benefit, as indicated by one participant:

"It might actually reduce appointments with patients, you know, if they're effectively managing things more themselves at home, or you know that we're getting the garments right, that could ultimately reduce appointments. And be a more positive impact for the patients" [P7].

Despite this, there was a perceived need to explore and quantify the health economic benefit as evidence for the health service investment: "I mean there is certainly a cost ongoing, like the consumables associated with it as well as the workforce, so the research is going to be important in terms of evaluation of outcomes to show the difference that it makes and provide evidence to management around the benefits" [P8].

The importance of workflow sustainability was also noted, particularly if there is continued service demand from patients, as highlighted by one participant "I think the patient/patients positive experience of the clinic and the outcomes... I think that's a huge enabler as well" [P1]. Other workflow considerations expressed by participants included the ability of the service to adjust to staff turnover and a rotational workforce, which is common to the clinical setting. The number of trained staff, timing of training and skill maintenance were reported as important considerations that may hinder long term success. A key example from one participant noted: "I think for it to be successful and looking at implementing it in other areas you definitely need a larger group of people involved to guarantee the sustainability... it's got to be something that a number of people can deliver" [P3]. Another participant also commented "obviously it has to be run by a highly skilled clinician, so, one of the barriers and enablers would be to continue the training" and "how is that going to be over the long term, so I guess that workforce sustainability issues are things that need to be worked on in the next phase" [P8]. Ongoing staff changes brings potential for variability in future staff attitudes which may influence the ongoing prioritisation of the clinic within the setting.

Ongoing support from key influential staff and the organisation was also seen as a factor for success over time. Clinic alignment with organisational priorities and the wider service context was emphasised by one participant who explained "I think potentially it needs to be a model that fits in with the broader population group and then how does that fit in with the whole lymphoedema across [the health service] model" [P8]. Staff attitudes towards the innovation, particularly those who were seen as influential, were important in championing and maintaining the service. For example, "A lot of the buy-in was around the research and it being an innovative new clinic, but, you

know, whether priorities might change from the medical perspective in the future, around how they wish to use their time, you know if something else comes up that they would prefer to invest their time in, that could be obviously a huge barrier to the clinic as well" [P1].

4 | DISCUSSION

This ICG lymphography clinic was successfully introduced in an outpatient lymphoedema service. Despite the challenges arising during the implementation pilot phase, the clinic continues to operate as part of the ongoing service. Unsurprisingly with the application of a new innovation, complexities arose in applying the technology in practice which influenced the process of establishing the service. When considering new innovations, there is a disparity of resources applied to assessing innovation implementation comparative to innovation development (Demiris et al., 2014). The absence of focus on the necessities required for implementation makes predicting the complexities of implementing ICG lymphography challenging, and creates barriers for adoption into practice. This study is the first to report on these challenges in the application of ICG lymphography within an existing lymphoedema service. Exploration of staff perceptions and experiences of the implementation facilitated identification of these complexities. As expected, key factors identified by staff from various levels were grounded in themes common to many implementation frameworks, such as the evidence, implementation setting, and barriers and enablers to implementation (Atkins & Kupersmith, 2010).

Through the use of the CFIR as a guiding framework, a number of factors were identified to consider for future adoption of ICG lymphography to practice. The CFIR domains include characteristics of the intervention (e.g., evidence, complexity and trialability), outer setting (e.g., wider networks), inner setting (e.g., organisational culture and implementation readiness), characteristics of individuals (e.g., relative importance to those involved) and implementation process (e.g., planning, engaging, executing and reflecting). While no data fell outside CFIR domains, notable factors for the clinic establishment such as staff knowledge and beliefs, were found to interrelate and span across CFIR domains rather than relating to an isolated CFIR domain alone. Importantly, the perceived benefits of the innovation characteristics (i.e., evidence for ICG lymphography) influenced individuals' beliefs and were reported to seemingly outweigh potential barriers incurred in the process of implementation. This highlights how barriers and enablers can interrelate and work synergistically during implementation. In the case of ICG lymphography, acquiring complex equipment, integrating it into local systems, and building and maintaining a skilled workforce for continued service delivery were a challenge. Though the uniqueness of the innovation was seen as a barrier by some, the information obtained by using the technology in the absence of suitable alternatives was ultimately an enabling factor to drive the adoption of the innovation.

Another notable enabler was the multifaceted concept of 'support' which highlighted that the beliefs and perspectives of

individuals involved (i.e., staff) can be a facilitator across CFIR domains. The notion of support from champions or opinion leaders is a known enabler in healthcare implementation (Miech et al., 2018). Although, in this case, support included staff at all levels, the staff themselves identified the importance of 'influential' people (such as those in leadership or 'middle management' roles) as crucial. This is reflective of the work of Birken (2013) who conducted a sequential mixed method study of middle managers and health centres in the United States and identified that proactive 'middle managers' with a positive attitude towards implementation positively influenced and promoted implementation effectiveness. As such, in addition to implementation champions, there is a need to increase early engagement of influential staff to gain positive support for shaping and motivating broader onboarding to the implementation process for ICG lymphography clinic development.

Staff perspectives and beliefs heavily shaped their support for this implementation. Greenhalgh et al. (2004) highlighted "the meaning of the innovation for the intended adopter has a powerful influence on the adoption decision" (p. 599). Similarly, this study identified that when staff themselves believed in the innovation and found it meaningful, barriers to adoption were perceived as surmountable. Interestingly, positive staff beliefs were fuelled by staff perceptions of the patient impact as much as their knowledge of the innovation. The experience of direct or indirect feedback from the patient experience was a motivator to staff, and favourably influenced their beliefs in the innovation. As health services continue to pursue value-based care, with the patient experience and impact prioritised (Teisberg, Wallace, & O'Hara, 2020); the processes for service implementation must too prioritise the patient experience, which can be a useful tool early in the adoption phase to garner support for an innovation.

There were a number of limitations in this study, particularly the small number of participants. However, given the specialist nature of the service, this small number encompassed all of those available who were eligible for inclusion. Another challenge was the role of the principal investigator as a key clinical lead in the local setting. However, as an insider researcher, the methodology used acknowledges the value of the researchers' experience in interpreting responses (Fleming, 2018; Thorne, 2016). Another limitation was the lack of 'high level' evidence for ICG lymphography implementation, given that translation of evidence to practice research is intended to focus on robust refined evidence (Khoddam et al., 2014). However, the authors propose the application of an implementation framework such as the CFIR to the translation of emerging innovations to practice, demonstrates their value in understating the implementation process and potential for proactively guiding implementation to narrow the evidence-practice gap. Further work is necessary to understand the health economic impact for sustainability of ICG lymphography over time. Despite these limitations, the adoption of this innovation has enabled people with chronic lymphoedema in the local setting access to ICG lymphography to inform their lymphoedema assessment and therapy planning.

5 | CONCLUSION

Complex innovations with emerging evidence, such as ICG lymphography, can be successfully implemented in clinical practice. Examining the process of translation to practice can assist in identifying the determinants necessary for adoption and sustainability. Multiple factors influenced successful adoption of ICG lymphography in this study. Identified barriers such as the complexity of the innovation itself, resource availability and the target setting were influenced by key enablers, notably the beliefs of the individuals involved. It was necessary to view these synergistically rather than as competing in importance due to the interrelation of each factor. The use of the CFIR implementation framework was a valuable tool to understanding the necessary components for sustainable practice adoption of the innovation.

AUTHORS CONTRIBUTION

Article conception and design (MT, SB, AP), data collection (ED), data analysis and interpretation (MT, SB, ED, FP, AP), manuscript development (MT), manuscript revision and final approval (MT, SB, ED, FP, AP).

ACKNOWLEDGEMENTS

The Occupational Therapy Department of the Princess Alexandra Hospital provided in-kind support for the clinical service and research. Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australian University Librarians.

FUNDING INFORMATION

In-kind support of the Occupational Therapy Department of the Princess Alexandra Hospital, Queensland, was provided for this research.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

ORCID

Megan Trevethan  <https://orcid.org/0000-0002-7293-2275>

Sally Bennett  <https://orcid.org/0000-0002-4353-5027>

Emmah Doig  <https://orcid.org/0000-0002-7020-053X>

Freyr Patterson  <https://orcid.org/0000-0003-3498-5824>

Amanda Pigott  <https://orcid.org/0000-0002-6254-0788>

REFERENCES

- Akita, S., Nakamura, R., Yamamoto, N., Tokumoto, H., Ishigaki, T., Yamaji, Y., Sasahara, Y., Kubota, Y., Mitsukawa, N., & Satoh, K.(2016). Early detection of lymphatic disorder and treatment for lymphedema following breast cancer. *Plastic and Reconstructive Surgery*, 138(2), 192e–202e. <https://doi.org/10.1097/PRS.0000000000002337>
- Atkins, D., & Kupersmith, J.(2010). Implementation research: A critical component of realizing the benefits of comparative effectiveness research. *The American Journal of Medicine*, 123(12), e38–e45. <https://doi.org/10.1016/j.amjmed.2010.10.007>
- Birken, S. A., Lee, S.-Y. D., Weiner, B. J., Chin, M. H., & Schaefer, C. T.(2013). Improving the effectiveness of health care innovation implementation: Middle managers as change agents. *Medical Care Research and Review*, 70(1), 29–45. <https://doi.org/10.1177/1077558712457427>
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F.(2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research*, 26(13), 1802–1811. <https://doi.org/10.1177/1049732316654870>
- Boyages, J., Koelmeyer, L. A., Suami, H., Lam, T., Ngo, Q. D., Heydon-White, A., Czerniec, S., Munot, S., Ho-Shon, K., & Mackie, H.(2020). The ALERT model of care for the assessment and personalized management of patients with lymphoedema. *British Journal of Surgery*, 107(3), 238–247. <https://doi.org/10.1002/bjs.11368>
- Bradshaw, C., Atkinson, S., & Doody, O.(2017). Employing a qualitative description approach in health care research. *Global Qualitative Nursing Research*, 4, 233339361774228. <https://doi.org/10.1177/2333393617742282>
- Braun, V., & Clarke, V.(2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
- Chang, W. D., Suami, W. H., & Skoracki, W. R.(2013). A prospective analysis of 100 consecutive lymphovenous bypass cases for treatment of extremity lymphedema. *Plastic and Reconstructive Surgery*, 132(5), 1305–1314. <https://doi.org/10.1097/PRS.0b013e3182a4d626>
- Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C.(2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science*, 4(1), 50. <https://doi.org/10.1186/1748-5908-4-50>
- Demiris, G., Parker Oliver, D., Capurro, D., & Wittenberg-Lyles, E.(2014). Implementation science: Implications for intervention research in hospice and palliative care. *Gerontologist*, 54(2), 163–171. <https://doi.org/10.1093/geront/gnt022>
- Dwyer, S. C., & Buckle, J. L.(2009). The space between: On being an insider-outsider in qualitative research. *International Journal of Qualitative Methods*, 8(1), 54–63. <https://doi.org/10.1177/160940690900800105>
- Dylke, E. S., Schembri, G. P., Bailey, D. L., Bailey, E., Ward, L. C., Refshauge, K., Beith, J., Black, D., & Kilbreath, S. L.(2016). Diagnosis of upper limb lymphedema: Development of an evidence-based approach. *Acta Oncologica (Stockholm, Sweden)*, 55(12), 1477–1483.
- Fleming, J.(2018). Recognizing and resolving the challenges of being an insider researcher in work-integrated learning. *International Journal of Work-Integrated Learning*, 19, 311–320.
- Glasgow, R. E., & Emmons, K. M.(2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health*, 28(1), 413–433. <https://doi.org/10.1146/annurev.publhealth.28.021406.144145>
- Grada, A. A., & Phillips, T. J.(2017). Lymphedema: Pathophysiology and clinical manifestations. *Journal of the American Academy of Dermatology*, 77(6), 1009–1020. <https://doi.org/10.1016/j.jaad.2017.03.022>
- Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O.(2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *The Milbank Quarterly*, 82(4), 581–629. <https://doi.org/10.1111/j.0887-378X.2004.00325.x>
- Jørgensen, M. G., Hermann, A. P., Madsen, A. R., Christensen, S., & Sørensen, J. A.(2021). Indocyanine green lymphangiography is

- superior to clinical staging in breast cancer-related lymphedema. *Scientific Reports*, 11(1), 21103. <https://doi.org/10.1038/s41598-021-00396-2>
- Khoddam, H., Mehrdad, N., Peyrovi, H., Kitson, A. L., Schultz, T. J., & Athlin, A. M. (2014). Knowledge translation in health care: A concept analysis. *Medical Journal of the Islamic Republic of Iran*, 28, 98.
- Kirk, M. A., Kelley, C., Yankey, N., Birken, S. A., Abadie, B., & Damschroder, L. (2016). A systematic review of the use of the Consolidated Framework for Implementation Research. *Implementation Science*, 11(1), 72. <https://doi.org/10.1186/s13012-016-0437-z>
- Koelmeyer, L. A., Borotkanics, R. J., Alcorso, J., Prah, P., Winch, C. J., Nakhel, K., Dean, C. M., & Boyages, J. (2019). Early surveillance is associated with less incidence and severity of breast cancer-related lymphedema compared with a traditional referral model of care. *Cancer*, 125(6), 854–862. <https://doi.org/10.1002/cncr.31873>
- Koelmeyer, L. A., Thompson, B. M., Mackie, H., Blackwell, R., Heydon-White, A., Moloney, E., Gaitatzis, K., Boyages, J., & Suami, H. (2020). Personalizing conservative lymphedema management using indocyanine green-guided manual lymphatic drainage. *Lymphatic Research and Biology*, 19, 56–65. <https://doi.org/10.1089/lrb.2020.0090>
- Lynch, E. A., Mudge, A., Knowles, S., Kitson, A. L., Hunter, S. C., & Harvey, G. (2018). "There is nothing so practical as a good theory": A pragmatic guide for selecting theoretical approaches for implementation projects. *BMC Health Services Research*, 18(1), 857. <https://doi.org/10.1186/s12913-018-3671-z>
- Miech, E. J., Rattray, N. A., Flanagan, M. E., Damschroder, L., Schmid, A. A., & Damush, T. M. (2018). Inside help: An integrative review of champions in healthcare-related implementation. *SAGE Open Med*, 6, 2050312118773261. <https://doi.org/10.1177/2050312118773261>
- Mihara, M., Hara, H., Araki, J., Kikuchi, K., Narushima, M., Yamamoto, T., Iida, T., Yoshimatsu, H., Murai, N., Mitsui, K., Okitsu, T., & Koshima, I. (2012). Indocyanine Green (ICG) lymphography is superior to lymphoscintigraphy for diagnostic imaging of early lymphedema of the upper limbs. *PLoS One*, 7, e38182.
- Peters, D. H., Adam, T., Alonge, O., Agyepong, I. A., & Tran, N. (2013). Implementation research: What it is and how to do it. *British Medical Journal*, 347, f6753. <https://doi.org/10.1136/bmj.f6753>
- Pigott, A., Doig, E., McCann, A., & Trevethan, M. (2021). It was just mind blowing to be honest: a qualitative phenomenological study exploring cancer survivor's experiences of indocyanine green lymphography used to inform lymphedema therapy management. *Supportive Care in Cancer*, 29, 6389–6397. <https://doi.org/10.1007/s00520-021-06229-2>
- Rockson, S. G., Keeley, V., Kilbreath, S., Szuba, A., & Towers, A. (2019). Cancer-associated secondary lymphoedema. *Nature Reviews. Disease Primers*, 5(1), 22. <https://doi.org/10.1038/s41572-019-0072-5>
- Suami, H. (2012). Using indocyanine green fluorescent lymphography to demonstrate lymphatic architecture. *Journal of Lymphoedema*, 7(2), 25–29.
- Suami, H., Koelmeyer, L., Mackie, H., & Boyages, J. (2018). Patterns of lymphatic drainage after axillary node dissection impact arm lymphoedema severity: A review of animal and clinical imaging studies. *Surgical Oncology*, 27(4), 743–750. <https://doi.org/10.1016/j.suronc.2018.10.006>
- Teisberg, E., Wallace, S., & O'Hara, S. (2020). Defining and implementing value-based health care: A strategic framework. *Academic Medicine*, 95(5), 682–685. <https://doi.org/10.1097/ACM.0000000000003122>
- Thomas, D. R. (2017). Feedback from research participants: Are member checks useful in qualitative research? *Qualitative Research in Psychology*, 14(1), 23–41. <https://doi.org/10.1080/14780887.2016.1219435>
- Thomis, S., Devoogdt, N., De Vrieze, T., Bechter-Hugl, B., Heroes, A. K., & Fourneau, I. (2022). Relation between early disturbance of lymphatic transport visualized with lymphofluoroscopy and other clinical assessment methods in patients with breast cancer. *Clinical Breast Cancer*, 22(1), e37–e47. <https://doi.org/10.1016/j.clbc.2021.06.015>
- Thorne, S., Kirkham, S. R., & Macdonald-Emes, J. (1997). Interpretive description: A noncategorical qualitative alternative for developing nursing knowledge. *Research in Nursing & Health*, 20(2), 169–177. [https://doi.org/10.1002/\(sici\)1098-240x\(199704\)20:2<169::aid-nur9>3.0.co;2-i](https://doi.org/10.1002/(sici)1098-240x(199704)20:2<169::aid-nur9>3.0.co;2-i)
- Thorne, S. E. (2016). *Interpretive description: qualitative research for applied practice* (Second ed.). Routledge.
- Thornicroft, G., Lempp, H., & Tansella, M. (2011). The place of implementation science in the translational medicine continuum. *Psychological Medicine*, 41(10), 2015–2021. <https://doi.org/10.1017/S0033291711000109>
- Wensing, M., & Grol, R. (2019). Knowledge translation in health: How implementation science could contribute more. *BMC Medicine*, 17(1), 88. <https://doi.org/10.1186/s12916-019-1322-9>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Trevethan, M., Bennett, S., Doig, E., Patterson, F., & Pigott, A. (2022). Navigating the application of new innovations: Establishing an indocyanine green lymphography clinic in Australia. *Health & Social Care in the Community*, 30, e5549–e5559. <https://doi.org/10.1111/hsc.13979>