ORIGINAL RESEARCH

E-Health readiness in outback communities: an exploratory study

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A B S T R A C T

Introduction: E-health has been a recurrent topic in health reform, yet its implementation, ultimate role and feasibility are yet to be clearly defined. Organisations such as the Royal Flying Doctor Service South East Section (RFDS SE) are in a position to utilise technology to enhance the effectiveness of existing clinical services for remote communities. The study aim was to explore the readiness of the remote population of far-west New South Wales, Australia, and RFDS SE as a monopoly service provider to take up e-health innovations.

Methods: A convenience sample of patients sequentially attending 15 remote fly-in clinics conducted by RFDS SE medical officers were invited to participate in a semi-structured telephone survey using an established survey tool to gather quantitative and qualitative data. RFDS SE health staff and managers were also surveyed.

Results: The overall core-readiness to embrace new e-health technologies was at a moderate level; barriers were mainly technical competence and technology availability. Enablers were willingness to learn and engage. The majority of patients did not feel isolated and had their health needs met; albeit there was interest in change if this improved outcomes. Video consultations for mental health and access to specialists were particularly welcome, although responses also indicated concern that video links might replace existing face-to-face services. Health staff saw the need for new technology to assist in healthcare provision but technology availability and support were flagged as key points. Organisational views as elicited from managers identified internal needs for workplace readiness to assist with adoption of new technology.

Conclusions: Patients, healthcare providers and RFDS SE as an organisation are interested in engaging in e-health to improve the level of healthcare delivery. There are challenges around the technical capacity and the structural and organisational support for an e-health venture in an outback setting. Specific patient, healthcare provider and organisational needs have been identified and allow for the development of a tailor-made implementation strategy particularly to overcome technical challenges.

Key words: Australia, e-health, e-health implementation, healthcare delivery, RFDS, telehealth, telemedicine.

Introduction

In the 1920s, John Flynn and Alf Traeger started a long-standing Royal Flying Doctor Service tradition of using telecommunications to facilitate healthcare delivery in remote Australia, telehealth in its prime[1].Today the term 'e-health' is used to describe the transfer of health resources and provision of health care by electronic means[2]. E-health has been a recurrent topic in health reform, yet its implementation is complex[3]. A recent consumer survey about rural telehealth indicated a need for e-health technology but identified significant barriers[4]. It is currently not known what patients in rural and remote Australia want and need from e-health, nor what their concerns are. Similarly, as shown in Table 1, innovation in e-health requires an exploration of the views and needs of healthcare providers serving patients who might potentially benefit from e-health. The background and rationale for the three components of this study derive from these issues, and are outlined below.

Royal Flying Doctor Service setting

The Royal Flying Doctor Service South East Section (RFDS SE) provides traditional outreach visits to remote communities. In addition, it offers telehealth consultations to those in its geographic region 24 hours a day. As a result, the RFDS 'on call' medical officer (MO) consults with remote clinic nurses and patients from isolated properties in far-west New South Wales and surrounds by telephone. Over 5000 telehealth consultations typically are provided in any year[21]. Newer forms of electronic communication, such as video consultations, are under active consideration by RFDS SE in line with recent health reform[22]. Australia's national government has introduced the national broadband network (NBN) and personally controlled electronic health records (PCEHR) as ways to assist healthcare provision (see http://health.gov.au/ehealth-nbntelehealth). However, it is not clear how patients, healthcare providers and organisations in outback communities perceive these initiatives.

Readiness assessment and implementation theory

Roger's diffusion of innovations theory states that the pre-existing stage of readiness is important for implementation of new policies, practices or technologies[23]. To inform the selection of interventions targeting professionals or their patients to promote the uptake of technologies, the Cochrane Collaboration Effective Practice and Organisation of Care Group (EPOC) recommends a needs assessment for each unique context of innovation or reform[24]. Implementation strategies can then be designed in response to unique barriers and maximise opportunities for change[25].

Aim of the current study

This study was designed to explore readiness for e-health in outback Australia by surveying RFDS SE health staff, managers and patients.

Methods

There is a number of existing instruments designed to measure readiness for telehealth[26,27]. One Canadian instrument[28] has been especially recommended for its versatility across diverse projects to support implementation of telemedicine. This tool was adapted as described below.

Table 1: Key issues in e-health implementation[5-20]

Literature review	Key statement	Reference	Type
E-health implementation	Sustainability can be achieved by carefully considering the 'clicks' (e-health content) and the 'bricks' (structures and context) and the right 'tricks' (intervention strategy for implementation process).	5	Other
E-health implementation by healthcare professionals	At present, there is no gold-standard intervention to promote uptake of new technology by clinicians.	6	Cochrane Review
E-health uptake by healthcare professionals	Funding, time, infrastructure and equipment, skills and preference for traditional approach are some of the barriers for uptake of telemedicine identified by healthcare providers.	7	Other
Telemedicine for chronic disease management	Interestingly, there is a lack of evidence for telehealth and chronic disease management. This could be a phenomenon due to a lack of quality trials.	8	Review of RCT
Telehealth implementation	Success factors include appropriate planning and consulting with key stakeholders on all levels (from end user to professional and policy-maker/management) particularly to see if the technology is actually needed and to ensure adequate technical availability and support.	9	Other
Telemedicine versus face-to-face patient care	Telemedicine is feasible but there is lack of evidence when it comes to health outcomes. End users were satisfied with their experiences in the setting of self-monitoring at home or having video consultations.	10	Cochrane
Telephone consultation and triage	Some issues can be dealt with on the phone, leading to reduction in surgery contacts, after-hours face-to-face consultation and maintaining patient satisfaction. Clinicians need to be vigilant to ensure patient safety.	11	Cochrane
E-health implementation strategy	Learning from the past and avoiding mistakes that others have made will allow for an optimal decision-making process. Consultation with end users and sharing information in various ways can promote knowledge translation.	12	Other
E-health implementation enablers	Among other factors, community support was key to implementation success. Other factors were positive leadership, supportive management and policy-making and favourable infrastructure, workforce and funding.	13	Systematic review
M-health	Mobile phone messaging can help in self-management of chronic illnesses, but, for example, there are information gaps when it comes to long-term effect, costs, risks and acceptability.	14	Cochrane Review
Email	No recommendations can be made. There is not much quality evidence at present and more research is needed.	15	Cochrane Review
E-health readiness of allied health sector	Multiple clusters identified (see report0; interestingly, Aboriginal health workers are the first to make use of new technology.	16	Survey report
E-health readiness of medical specialists	Emergency physicians have the highest rate of adoption. Psychiatrists, on average, are more late adopters. GPs are not mentioned.	17	Survey report
Mental health setting	Technology provides a promising method for the mental health setting; however, evidence currently suggests that standard care is still the gold standard. More high-quality research could lead to a clearer role of e-health in the mental healthcare setting.	18	Cochrane Review
E-health implementation boundaries	Technical challenges such as interoperability issues and structural boundaries impede uptake of e-health. Professional boundaries are another cause, mainly understanding and accepting the concept of sharing information in new ways. Technology might have advanced, but clinicians are often not ready to use it yet. Consultation with all stakeholders is advisable prior to implementing change.	19	Other
E-health risks and benefits to consumers	Patient autonomy can potentially be boosted by new technology, possibly leading to better health outcomes. Risks exist with e-Health technologies and these need to be identified and addressed.	20	Report

RCT, randomised controlled trial.

Provider and organisational surveys

A nine-page instrument for healthcare providers containing 48 quantitative questions assessing core, engagement and structural readiness was customised. Satisfaction with status quo of healthcare delivery and options for change were key components. A qualitative section gave participants the opportunity to express their thoughts on e-health technologies in more detail. In December 2012, paper-based copies of this instrument were distributed to each member of the RFDS SE Health Services Department (HSD) to ensure all nursing, mental health, medical and dental staff could complete their survey anonymously.

A parallel version of the HSD instrument was developed for simultaneous administration to managers in RFDS SE to identify their perceptions, awareness and ideas about e-health technology. Forty-eight questions assessed core, engagement and workplace readiness and awareness of existing and future technology needs, internal planning, communication and administrative, human, and physical structures. All senior managerial RFDS SE Broken Hill staff were also invited to complete a paper-based survey anonymously in December 2012.

Client survey

This instrument was designed for RFDS SE clinic patients as a structured telephone interview with qualitative and quantitative items. It comprised basic demographic questions and three further parts (A, B and C). During development, it was pilot-tested with staff and volunteers not included in the main study to fine-tune the instrument in terms of readability and user-friendliness. Part A examined the patient's current healthcare situation and how it met their needs. Part B addressed e-health technology and how it might be useful. Part C further explored technology currently available to patients.

A convenience sample of patients sequentially attending 15 remote RFDS SE fly-in clinics during a two-week period in April and May 2013 was invited to participate. Sufficient copies of the study consent form were given to the attending

MO every day for distribution in conjunction with local clinic staff. An information sheet was given to each patient with a consent form attached. The completed consent forms were returned in a sealed envelope to the RFDS SE base and processed by the research team. The telephone survey was then conducted at the patient's convenience. Data from very small, potentially identifiable communities have been collated before publication to further protect their identity.

Copies of the survey instruments can be obtained by contacting the corresponding author.

Sample sizes and statistical analysis

Provider and organisational surveys: Sample sizes for these surveys were determined by organisational size. Specifically, all eligible staff were surveyed. As both HSD and manager surveys were anonymous, response aiding strategies were not deployed at the level of the individual. Non-responders were never identifiable, precluding any assessment of response bias. Participation was encouraged through email notices and announcements at staff meetings.

Client survey: The patient sample size was pragmatically determined: resources restricted patient recruitment to a four-week period, divided into two blocks. RFDS SE provides on average about 600 remote clinic consultations per month across all clinics from its base in Broken Hill. The required target population size was estimated to be 200, assuming a worst-case scenario of a 25% response rate, which would result in a final sample size of 50. If 30% of patients are ready for e-health at baseline, this sample size would be sufficient to detect this with a 95% confidence interval of 0.1215.

Analysis: Information from returned surveys and telephone interviews was coded and entered into an Excel database. Frequencies were determined for basic demographic information and item responses. Calculation of scores per individual answer and subsection was undertaken as follows: each quantitative question in parts A–C was coded with a score of zero to five as per original design[28].

Table 2: E-health readiness score interpretation (adapted from Jennett et al[28])

Category	Interpretation	Healthcare provider score	Organisational score	Client score
Low	There are barriers to successful use of e-health.	<60	<85	<50
Moderate	Certain items may adversely impact the use of e-health.	60–80	86–129	50–70
High	In a good position to use e-health.	>80	>130	>70

E-health readiness scores were calculated by adding all three core components, resulting in three different readiness categories: 'low', 'medium' and 'high' (Table 2). Low signifies that there are barriers for successful uptake of e-health. Medium signifies that certain items may adversely impact on implementation of e-health. High signifies a good position for e-health implementation. Qualitative responses were also entered into the same database.

Ethics approval

Ethics approval was obtained from the University of Sydney Human Research Ethics Committee (approval number 2012/2823).

Results

Response rates and e-health scores

Healthcare provider (HSD) survey: Of 30 health service providers in RFDS SE, 13 staff members completed and returned surveys (43% response rate). Service providers had a high–moderate readiness score of 76 (Table 3). The technical readiness score was the lowest, suggesting major impediments ahead in implementation.

Healthcare providers were particularly concerned about privacy issues, technical support and vulnerability to technical failures, but could see benefits of e-health technology for clinical decision-making, patient safety and service delivery (Table 3, identified themes).

Healthcare providers deemed the PCEHR to be only slightly effective in improving patient care. By contrast, video consults were deemed somewhat effective in improving patient care for the following clinical settings: standard consultation, emergency care, chronic disease and mental health care (Table 3, additional comments).

Organisational (managers) survey: Of six managers, five completed and returned surveys (83% response rate). Their average e-health readiness score was 123 out of 245 (range 80–157), equating to a moderate level of readiness for e-health. Table 4 shows that core need for e-health and planning readiness were high among managers; however, workplace readiness scores were moderate. Managers were overall confident of having adequate technical support. Table 5 displays workplace readiness in subsections, revealing key challenges ahead, such as policies and procedures and professional and regulatory barriers.

Client survey: Of 172 patients attending clinics during the survey period, 62 consented to participate (response rate 36%). However, only 45 participants could be reached to complete the phone interview. As shown in Table 6, overall core-readiness in the community was calculated as moderate. More than two-thirds of the population interviewed did not feel isolated and considered that their health needs were met. However, nearly all patients had a

desire for change, particularly with respect to the model of healthcare delivery (Table 6). More than two-thirds had heard about telehealth. Ninety-one percent found video links helpful to overcoming cultural barriers, 88% found them useful for accessing specialists and 84% found them acceptable for mental health consultations. The majority found video links an addition to — rather than a replacement for — existing services (Table 6). Further, 95% indicated they felt in control of patient and community well-being. In their comments, several participants expressed concerns about losing face-to-face local health services as technology was introduced.

Almost all, 95%, were aware of the NBN but only 35% were aware of the PCEHR. Bandwidth issues and/or lack of NBN availability were mentioned as key issues by several participants in their qualitative comments.

Interest in further information sessions on e-health topics was high (Table 6). However, only 31% of the participants had access to mobile phone coverage with integrated video technology and only 55% had access to the necessary equipment for video consults from home. Finally, more than half (52%) were not tech-savvy enough to assist a neighbour with setting up a video link. Table 6 presents a selection of comments.

Discussion

Patient readiness is a key factor for the successful implementation of any given primary healthcare delivery model, including e-health[29].

RFDS SE patients and providers were willing to engage in e-health as it is perceived as an overall benefit to the community. These results are supported by a previous survey published in January 2013 by the Consumer Health Forum[4]. Current literature suggests that e-health benefits rural communities and has a potential to decrease the 'urban–rural health disparities' and even improve 'rural medical workforces recruitment and retention'[30].

The patients and healthcare providers who participated in this exploratory study perceived technological barriers as one major hurdle, in line with current literature[7]. This reflects the need for adequate funding to allow for quality infrastructure, equipment and on-demand technology support for end users as pointed out by clinicians and patients alike. In contrast, 60% of managers felt that current information support was adequate. All stakeholders were willing to engage with new technology to extend the traditional approach to include e-health for appropriate settings.

Implications for implementation

Results from the patient survey can assist organisations such as RFDS SE with the introduction of e-health with a particular focus on video consultations in remote emergency rooms and for access to medical specialists.

An implementation approach could include educational components based on Roger's work on innovation[31], EPOC resources[25] and the Ottawa model[23], which can serve as relevant frameworks for adoption of innovations such as e-health technology[32]. The theory of diffusion of innovation focuses on the way in which new ideas or technologies (innovations) spread through groups or communities. Diffusion of innovation theory places important emphasis on innovators as 'change agents' who identify with the concerns of the community and influence decisions about the adoption of an innovation[33].

For example, one focus of the implementation project is on the knowledge stage, where individuals learn about e-health innovations. Subsequently, individuals are in the persuasion stage, where opinions are formed, positive or negative. This can serve as a guide for the subsequent roll-out of e-health innovations. The focus of EPOC is on interventions designed to improve professional practice with or without patient-mediated strategies and the delivery of effective health service; for example, in this case, to influence e-health delivery through patients' needs. The Ottawa model may be particularly useful for RFDS SE as it is a method developed within continuity-of-care innovations involving multiple settings and keeping a focus on patients' needs in the knowledge translation process.

Table 3: Healthcare provider survey readiness scores (*n*=13)

Readiness scores for healthcare providers	Average score	Range	Level of readiness (%)	Maximum possible score
Core	28	22–34	High (80%)	35
Engagement	32	24–39	High (80%)	40
Technical	16	9–22	Moderate (64%)	25
Total e-health readiness for staff	76	69–92	Moderate (76%)	100
Core readiness	**Engagement readiness**		**Technical readiness**	
69% (9/13) feel some frustration with current way of delivering care.	85% (11/13) have a sense of curiosity over how e-health solutions will improve the delivery of health care.		100% (13/13) agree that video consultations can address some access issues to specialists.	
77% (10/13) have first-hand experience of being isolated from healthcare services and adequate professional support because of lack of communication infrastructure.	85% (11/13) want to supplement existing phone consultations with video.		31% (4/13) have access to appropriate equipment and/or support to offer video consultations.	
77% (10/13) have a driving desire to address local healthcare needs; for example, by improving access to relevant specialists by offering video consultations.	62% (8/13) see themselves ready to offer video consultations for patients to access their specialist remotely.		69% (9/13) have enough IT knowledge or ability to gain it to run a video consultation.	
92% (12/13) have a strong desire to improve clinical decision-making by having patient history available through electronic means.	85% (11/13) see themselves ready to consult via video link for mental health-based problems.		31% (4/13) have access to good technical support and back-up plans in case of encountering technical difficulties with telehealth equipment.	
62% (8/13) see the need to change the way RFDS SE delivers on-call consultations.	62% (8/13) have the need to interact with other practitioners in a better way (for example, by electronic communication rather than by faxed or posted letter).		31% (4/13) have access to specialists who are willing to and can reliably offer video consultations.	
62% (8/13) feel the need to change the record system currently used for remote consultations and in-flight documentation/monitoring.	54% (7/13) know of practitioners who have had positive experiences with video consultations and are inspired to do the same.			
54% (7/13) feel the need to improve the way communication takes place with other healthcare providers.	69% (9/13) see themselves ready to invest the extra time it requires to implement new technologies.			
	92% (12/13) consider that the benefits of video consultations outweigh the harms, risks and limitations for RFDS SE.			
Themes identified from comments provided				
Negative: Lack of technology/internet availability and compatibility, vulnerability to technical failure and lack of technical support, privacy concern.				
Positive: Improving clinical decision-making, patient safety and service delivery. Video consult deemed somewhat effective in improving patient care for the following clinical settings: standard consultation, emergency care, chronic disease and mental health care. PCEHR deemed only little effective in improving patient care.				

PCEHR, personally controlled electronic health records; RFDS SE, Royal Flying Doctor Service South East Section.

Table 4: Organisational survey readiness scores (*n*=5)

Organisational readiness scores	Average score	Range	Level of readiness (%)	Maximum possible score
Core	9	5 –11	High (60%)	15
Engagement and planning	50	34–59	High (55%)	90
Workplace readiness (see Table 6 for details)	51	23–70	Moderate (44%)	115
Technical	13	6–20	High (52%)	25
Total e-health readiness for organisation	123	80–157	Moderate (50%)	245

Core readiness	Engagement readiness	Technical readiness
40% (2/5) are aware of and able to clearly articulate needs.	40% (2/5) have organisational buy-in for telehealth.	40% (2/5) have addressed the technical feasibility and technical requirement issues.
80% (4/5) express and feel dissatisfaction with the ways care is currently delivered.	60% (3/5) have individuals who are champions for telehealth.	20% (1/5) have established interoperability of equipment and technology.
0% (0/5) are (fully) aware of current e-health government initiatives in Australia.	60% (3/5) have leadership who are risk-takers and pioneers for reaching novel innovations.	40% (2/5) have a consistent approach to verification of the fidelity of data transmission.
	40% (2/5) are aware of organisational dynamics between innovators and resistors.	40% (2/5) have validated that the technology actually works.
	60% (3/5) have the commitment and support of senior administrators.	60% (3/5) have access to comprehensive technical support that is available locally and on-call.
	0% (0/5) have access to sufficient ongoing funding from local, provincial and federal institutions.	
	20% (1/5) have established collaborative partnerships.	
	0% (0/5) have in place methods for telehealth communication, profiling and awareness and are actively involved in promoting these.	
	40% (2/5) have examples and evidence of telehealth applications in similar contexts.	
	0% (0/5) exhibit healthy inter-organisational dynamics in telehealth promotion activities.	
	60% (3/5) are willing to consider short-, medium- and long-term timelines for implementation.	
	40% (2/5) have established mechanisms of knowledge transfer among staff members.	
	60% (3/5) participate in a community consultation process.	
	60% (3/5) conduct ongoing needs assessments and analysis.	
	0% (0/0) have a strategic business plan for adopting new e-health technology but 40% have a marketing, communication and evaluation plan, and 20% had a financial plan for sustainability of e-health services.	

The barriers and enablers identified in this study are significant in demonstrating that a tailor-made, needs-based intervention strategy could assist organisations such as RFDS SE to adopt new technologies appropriately.

Hailey et al (2003) summarised the literature on determinants of success and failure in telehealth implementation[9]. This current exploratory study revealed the perceived needs of healthcare providers, organisational stakeholders and patients, including their preference for an approach genuinely motivated by the promise of better patient outcomes, cooperation of stakeholders, adequate support (technical, policy, financial and staff) and reliable equipment (Fig1).

Table 5: Workplace readiness (*n*=5)

Workplace readiness category	Points=% readiness	Range of points
Workplace prepared for telehealth technology and equipment	Average (15/30)=50%	4–22
Regarding policies and procedures and professional and regulatory barriers	Average (11/30)=37%	0–22
Regarding establishing open lines of communication	Average (9/15)=60%	4–12
Regarding addressing change-management readiness	Average (4/10)=40%	0–6
Regarding addressing human resources readiness	Average (6/15)=40%	1–10
Regarding addressing training and continuous professional development readiness	Average (7/15)=46%	4–9

Table 6: Client survey readiness scores (*n*=45)

Client readiness score	Average score	Range	Level of readiness (%)	Maximum possible score
Core	14	8–24	Moderate (56%)	25
Engagement	30	15–39	High (75%)	40
Technical	18	8–25	Moderate (60%)	30
Total e-health readiness	63	44–80	Almost ready, moderate (66%)	95

Core readiness	Engagement readiness	Technical readiness
73% (33/45) feel not isolated.	77% (35/45) have heard about telehealth.	55% (25/45) have the right equipment for video consults from home.
55% (25/45) are dissatisfied with status quo of healthcare delivery.	84% (38/45) would use video for mental health consultations.	95% (43/45) are aware of the NBN (but not necessarily have access to it).
55% (25/45) prefer video over phone.	82% (37/45) find a video link acceptable in general.	31% (14/45) have access to a mobile phone (+coverage) with video camera.
73% (33/45) have no unmet health needs.	77% (35/45) feel video links are safe and secure (or at least feel neutral).	84% (38/45) are interested in further information session on e-health topics.
91% (41/45) have a desire for change.	91% (41/45) feel video links are useful to overcome cultural and linguistic barriers.	48% (22/45) are tech-savvy enough to help others with setting up video links
	95% (43/45) feel video is an addition rather than replacement of conventional care.	35% (16/45) were aware of the PCEHR.
	95% (43/45) feel a sense of control over their wellbeing and that of their community.	
	88% (40/45) see a video link as useful tool to access specialists.	

Selected themes
Positive: Decrease need to travel and better access to specialists. Voiced interest in e-health such as video consults.
Challenges: Current technology not good enough to allow for e-Health services.
Concerns: Privacy or security concerns. Fear of losing face-to-face service.

NBN, National Broadband Network; PCEHR, personally controlled electronic health records.

- **Present: The use of coordinators and enthusiastic participants** (GPs, nurses, coordinators, practice managers, specialists etc.)
- **Required: Reliability of equipment, software, communications; adequacy of technical support and reliability of vendors**
  - The reliability of telehealth components will influence the degree of confidence in the technology and the ability to integrate telehealth with local practice patterns.
- **Required: National or regional political, economic and budgetary issues**
  - A relatively stable, supportive environment is needed if telehealth is to thrive.
- **Present: Perceived need for the telehealth service**
  - Has an adequate business plan been prepared? Is there adequate publicity? Is the alternative approach sufficiently effective?
- **Ongoing: Involvement of stakeholders in planning and ongoing liaison; health professionals' attitudes to training, changes in responsibilities, autonomy**
  - Involvement is necessary to encourage a sense of ownership and participation, acceptance of benefits and to make appropriate modifications to the telehealth program.
- **Ongoing: Stability of management structures; turnover of personnel**
  - Continuity and consistency in personnel and other management is important.
- **Required: Cooperation and competition between organisations involved in networks**.

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Figure 1: Determinants of success and failure in telehealth[9] and recommendations for the Royal Flying Doctor Service South East Section from this exploratory study.

Conclusions

This is the first Australian attempt to explore the views of staff, managers and patients simultaneously in an assessment of needs, views and barriers prior to implementation of e-health. While interpretation of the study results is limited by relatively modest sample sizes, it was found that clinic patients, healthcare providers and RFDS SE as an organisation are interested in engaging in e-health to improve the level of healthcare delivery. However, there are challenges around the technical capacity and the structural and organisational support for an e-health venture in an outback setting. Specific patient, healthcare provider and organisational needs have been identified and allow for the development of a tailor-made implementation strategy particularly to overcome technical challenges.

The approach taken in this study could be expanded using a pre-post test design to permit rigorous evaluation of e-health implementation.

Acknowledgements

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