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Examining the use of telehealth in community nursing: identifying the factors affecting frontline staff acceptance and telehealth adoption

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Accepted for publication 21 June 2014

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TAYLOR J., COATES E., BREWSTER L., MOUNTAIN G., WESSELS B. & HAWLEY M.S. (2015) Examining the use of telehealth in community nursing: identifying the factors affecting frontline staff acceptance and telehealth adoption. *Journal of Advanced Nursing* **71**(2), 326–337. **doi: 10.1111/jan.12480**

Abstract

Aims. To examine frontline staff acceptance of telehealth and identify barriers to and enablers of successful adoption of remote monitoring for patients with Chronic Obstructive Pulmonary Disease and Chronic Heart Failure.

Background. The use of telehealth in the UK has not developed at the pace and scale anticipated by policy. Many existing studies report frontline staff acceptance as a key barrier, however data are limited and there is little evidence of the adoption of telehealth in routine practice.

Design. Case studies of four community health services in England that use telehealth to monitor patients with Chronic Obstructive Pulmonary Disease and Chronic Heart Failure.

Methods. Thematic analysis of qualitative interviews with 84 nursing and other frontline staff; and 21 managers and key stakeholders; data collected May 2012–June 2013.

Findings. Staff attitudes ranged from resistance to enthusiasm, with varied opinions about the motives for investing in telehealth and the potential impact on nursing roles. Having reliable and flexible technology and dedicated resources for telehealth work were identified as essential in helping to overcome early barriers to acceptance, along with appropriate staff training and a partnership approach to implementation. Early successes were also important, encouraging staff to use telehealth and facilitating clinical learning and increased adoption.

Conclusions. The mainstreaming of telehealth hinges on clinical 'buy-in'. Where barriers to successful implementation exist, clinicians can lose faith in using technology to perform tasks traditionally delivered in person. Addressing barriers is therefore crucial if clinicians are to adopt telehealth into routine practice.

Keywords: community health, innovation adoption, long-term conditions, nursing, technology, telehealth

Why is this research or review needed?

- The use of telehealth in the UK has not developed at the pace and scale anticipated despite policy support and industry efforts.
- Organizational, financial and technological barriers to successful implementation of telehealth and the mixed evidence about telehealth effectiveness have inhibited adoption.
- Frontline staff acceptance is an important factor in determining the successful adoption of new technologies, but has rarely been the central focus of study.

What are the key findings?

- Frontline staff acceptance of telehealth is a slow and fragile process that can be hindered by negative perceptions and experiences of telehealth in practice.
- Experimentation and clinical learning are important facilitators for staff acceptance of telehealth, and frontline staff play a key role in overcoming barriers to implementation.
- Experiencing patient and clinical benefits helps to instil trust and confidence in telehealth among staff, which was found to be essential for successful adoption.

How should the findings be used to influence policy/practice/research/education?

- The needs of frontline staff at different implementation stages must be recognized and supported if larger scale deployments of telehealth are to be achieved.
- Guidance on the practice of remote care through technology and the impact on patients and nursing care could facilitate increased adoption of telehealth.
- Design of telehealth services should seek to address barriers to frontline staff acceptance and facilitate opportunities for incremental clinical learning and service improvement.

Introduction

Telehealth is one of a range of assisted living technologies being used in health and social care services in the UK (Department of Health (2012a). In response to the challenges of an ageing population and a growth in the number of people with a long-term health condition in the UK, there has been significant progress in the development of assisted living technologies, which might enable people to lead more active and independent lives (Hendy *et al.* 2012). However, despite this and the associated policy support (Department of Health 2012a,b), the use of telehealth has not developed at the pace and scale anticipated.

Frontline staff acceptance of telehealth remains a key challenge in the adoption of this technology (Hendy *et al.* 2012, Brewster *et al.* 2013, Hanley *et al.* 2013), but has rarely been the focus of detailed study. This paper reports on qualitative research exploring the usage and acceptance of telehealth in community nursing.

Background

Telehealth has been defined as interventions that 'allow remote exchange of data (e.g. blood glucose and blood pressure readings) and additional information between a patient and healthcare professional(s) to assist in the diagnosis and management of health condition(s)' (Sanders *et al.* 2012, p. 2). The mainstreaming of telehealth is currently supported by UK government policy in the Department of Health's *3 Million Lives* programme (Department of Health 2012b) and the Technology Strategy Board funded *DALLAS* programme (Technology Strategy Board 2011). However, the uptake of telehealth has been slower than anticipated (Davies & Newman 2011, Greenhalgh *et al.* 2012, Broderick & Lindeman 2013). The mixed results from the Whole Systems Demonstrator trial (Steventon *et al.* 2012, Cartwright *et al.* 2013, Henderson *et al.* 2013) have played a part in limiting the expansion of telehealth, in that findings were less promising than early indications from Department of Health (2011) seemed to suggest, thereby acting as a disincentive for commissioners of health services who are increasingly expected to make evidence-based decisions (Clarke *et al.* 2013).

More general reporting on barriers and enablers to the implementation of telehealth both in the UK and Europe (Joseph *et al.* 2011, Fairbrother *et al.* 2013, de Vries *et al.* 2013) and in the US (Broderick & Lindeman 2013) has identified a broad range of contributory factors. These include the importance of close working in multi-disciplinary teams of clinicians, managers and technical personnel; the influence of staff reservations about change and the importance of staff training; having strong leadership and project management; identifying patients who might benefit the most and minimizing barriers to their uptake; technology functionality and interoperability; and the need for committed funding and strategic planning. Broderick and Lindeman (2013) also highlight the social dimension of implementation processes, the value of an open organizational culture and stress the significance of the long time horizon required to successfully scale up services.

The role of frontline staff acceptance features in these studies, but is rarely the central focus of research. A recent systematic review of factors affecting frontline staff

acceptance of telehealth (Brewster *et al.* 2013) sheds a more specific light on the debate, identifying numerous common themes in reporting to date. This narrative review showed that the impact of poor implementation processes and unresolved 'teething problems' in telehealth pilots had a lasting effect on staff acceptance. The review also documented nurse concerns about the impact on their relationships with patients and the change to their caring role, which in turn had an impact on clinical autonomy and credibility, especially where staff did not view telehealth as necessary or sufficiently beneficial. The provision of user-friendly and reliable technology, the presence of clinical champions and good collaboration between services, as well as good quality initial and ongoing training and support were all important facilitators of telehealth acceptance, as was assurance of patient safety.

However, Brewster *et al.* (2013) highlight that most of the findings came from randomized controlled trials, which are by definition highly controlled experiments and therefore may have limited external validity for healthcare services wishing to implement telehealth into usual practice (Finch *et al.* 2003, Hendy *et al.* 2012). The review concludes that implementation at scale will require normalization of telehealth into routine care by nursing staff and also, that greater understanding and acknowledgement of the impact of telehealth on nursing care and established practice are required. Acknowledging the important role of frontline staff in the adoption of new innovations (Greenhalgh *et al.* 2004), this study focuses on the use of telehealth in community healthcare settings, analysing staff accounts of using telehealth in everyday practice to examine acceptance and adoption over time.

The study

Aims

The purpose of this research was to explore the usage and acceptance of telehealth among frontline staff working in community nursing settings in England. The resulting rich data were analysed to identify the factors that can inhibit or alternatively promote successful telehealth.

Design

A qualitative case study design was used to understand how telehealth was being employed to monitor patients remotely in four community health services in England, including in-depth interviews and thematic analysis. This research was part of a broader study exploring the barriers and facilitators from an economic, organizational and user (staff and patient) perspective.

Participants

A purposive sampling strategy was used to select the case study sites. The inclusion criteria were that all sites had to be located in one geographical region of England; already using telehealth to remotely monitor patients with Chronic Obstructive Pulmonary Disease (COPD) and Chronic Heart Failure (CHF) who reside in the community; and be committed to expanding their current use of telehealth in the future. It was also important to capture diversity in terms of the scale of delivery, service model underpinning the technology use and stakeholders involved in providing telehealth. The key characteristics of each site are shown in Table 1.

A local lead collaborator was recruited in each site. This person played a key role in the management or delivery of telehealth and was able to identify the different community nursing teams using telehealth and other services involved in telehealth delivery, for example, equipment installation and telehealth monitoring.

A purposive sampling strategy was subsequently employed in each site to identify a range of staff experiences and to gather perspectives from the different services

Table 1 Case study site characteristics.

Research site identifier	Site A	Site B	Site C	Site D
Participant numbers				
Frontline staff	21	17	21	25
Managerial staff	6	6	7	2
Telehealth deployment				
Year of introduction	2007	2009	2006	2010
No. of telehealth units in use*	104	39	200	34
Referral routes into telehealth				
Community matrons	✓	✓	✓	✓
Case managers	✓			✓
Specialist respiratory nurses	✓	✓	✓	
Specialist heart failure nurses	✓	✓	✓	
General practitioners (GPs)	✓			
Telehealth stakeholders				
NHS community healthcare provider	✓		✓	✓
NHS hospital trust	✓			✓
Clinical commissioning group		✓	✓	
Equipment manufacturer	✓	✓	✓	✓
Local authority	✓	✓	✓	
Community interest company		✓	✓	
Private company		✓	✓	

*At end of data collection period in each site.

involved. The identification of more senior staff responsible for commissioning or managing telehealth was achieved through snowball sampling, beginning with those identified by the local lead collaborator. Relevant staff in the organizations identified were approached by the study manager and local lead collaborator from each site, to inform them of the research and invite them to take part in an interview. The research team then followed up individuals who expressed an interest in participating to arrange an interview and take informed consent.

One hundred and five interviews were completed across the four sites: with eighty-four frontline and twenty-one managerial staff recruited (site samples shown in Table 1). The sample size in each site was determined by the number of participating services and the size of community teams, as well as the local service design. Data saturation was also a key factor in determining the number of participants at both team and case level to adequately capture the range of opinions and experience in each site (O'Reilly & Parker 2013).

The majority of frontline participants held a professional nursing registration and had been in their current position for between 5 months–10 years. Other frontline staff held either a non-clinical role (technical and triage staff; administrators); a semi-clinical role (support workers; therapy assistants); or were general practitioners (GPs). Managerial staff participants held a variety of posts across the organizations involved in the commissioning and delivery of telehealth and included both clinical and non-clinical individuals with operational and more strategic or commissioning roles (participant characteristics shown in Table 2).

Table 2 Staff participant job roles.

Staff role	Number of participants
Advanced community nursing staff (*community matrons, specialist nurses, case managers*)	49
Other qualified nursing staff (*district nurses, cardiac nurses, telehealth nurses*)	9
Clinical leads and nursing service managers (*9 qualified nurses*)	10
Semi-clinical staff (*clinical support/care workers, telehealth installers*)	5
Non-clinical staff (*administrators, call handlers, technical staff, telehealth installers*)	8
General practitioners (GPs)	3
Organizational, strategic and commissioning managers	21
Total	**105**

Data collection

Data were collected via semi-structured interviews with all participants. An interview topic guide was used to elicit understanding of how telehealth is positioned in current services (context, service design, training, and technology/equipment issues). Information on staff roles and experiences of using telehealth and perspectives on barriers and facilitators were also included. The topic guide was piloted and refined after the first sub-set of interviews.

The majority of interviews were conducted face to face at participants' place of work and audio recorded with consent. Only one participant requested that their interview was not recorded (with notes taken instead of audio) and nine (9%) interviews were completed over the phone at the request of the participant. Interviews ranged from 14 minutes to 1-hour and thirty-six minutes and the median duration of the interviews was 45 minutes.

Audio recorded interviews were transcribed in full for the purpose of analysis. Existing documentation relevant to telehealth in each site was also collated, to supplement verbal accounts where appropriate. This included referral guidelines, evaluation reports, standard operating procedures and information about the community nursing teams. Data were collected between May 2012–June 2013.

Ethical considerations

A UK National Research Ethics Committee granted ethical approval for the conduct of the research (reference 11/YH/0034). Access to individual sites was granted via local health service research governance offices.

Data analysis

Framework analysis (Spencer *et al.* 2003) was used to structure and explore interview data. NVivo 9 software (QSR International Ply Ltd, Doncaster, Victoria, Australia) was used for managing and coding the transcripts. The coding framework was developed through a three-stage process. Initially, a systematic review of the literature on staff acceptance of telehealth was completed (Brewster *et al.* 2013) and identified seven broad themes, which in turn informed the data collection. Next, following a period of familiarization with the data from the first site, a thematic framework was generated, producing a working three-level coding framework with six main themes. A further refinement of the thematic framework was made following completion of the fourth case study. A test of inter-rater reliability was completed at the early stages of analysis, with the first and

second author independently coding several transcripts to the revised framework. Coding was then compared and minor disagreements were resolved by discussion before the final framework was applied across the whole dataset.

Research quality

The quality of the research was ensured against several criteria, including dependability, credibility and authenticity (Guba & Lincoln 1994). The five researchers (including JT, EC and LB) on the study used a standardized approach to data collection and a detailed audit of processes was kept to create dependability. Respondent validation was the key mechanism through which credibility of the research was ensured; key findings from each site were shared with all participants and a series of multi-stakeholder workshops were held to discuss and refine the issues identified in each site.

The ongoing relationship between the research team and the sites and the nature of the more active, subsequent phase of the wider project has provided further assurance of the authenticity of the work – leading, as it has, to identifiable tangible service changes in each location and the development of additional research activities to address some of the key questions that emerged from the case study findings.

Findings

Five main themes that were found to influence frontline staff acceptance of telehealth are reported here – working in a changing environment; the introduction of telehealth to frontline staff; experiencing and understanding telehealth; working out the technology and service design and; integrating telehealth into routine care.

Working in a changing environment

Recent policy and practice developments affecting community healthcare services, as well as broader changes in the English National Health Service (NHS), were identified as a barrier to the introduction of new technologies and other innovations across the sample. In each case study, re-structuring of community nursing teams, the integration of health and social care, the move to a paperless NHS, increasing demands on services to improve performance and the creation of the new Clinical Commissioning Groups were all raised as barriers to adopting new innovations requiring financial investment and implying new ways of working. While change was a recognized feature of the NHS, several staff described this particular era of change as unprecedented and overwhelming.

This changing context meant that the introduction of telehealth was viewed alongside other developments and initiatives, some of which were seen as a greater priority. In contrast, telehealth was sometimes regarded as optional and several nurses explained that it was not always on their radar. The number of new initiatives imposed in recent years also caused some participants to assess telehealth as yet another 'fad' and not necessarily leading to long-term future investment:

> There's a lot of change going on at the moment and...you just feel bombarded with all these new initiatives that are coming into place. And then there's, you know, all the telehealth that's going on and your mind is just constantly thinking 'oh god not another change, not another new thing' (Specialist Nurse 10, Site C)

Previous experience with new technologies at work, such as electronic patient records and mobile working via secure laptops, shaped frontline staff views of technology adoption. Some participants resisted this wider trend and reported concerns about the potential impact on workload. Others welcomed the incorporation of technology into their work, as they observed the greater societal use of technology and the resulting efficiencies.

The introduction of telehealth to frontline staff

Initial impressions of telehealth were important and in all the case study sites, its introduction into practice was surrounded by uncertainty and ambiguity regarding its role: whether telehealth was a new technology, a new clinical tool or a new system for delivering care remotely. This ambiguity was interwoven in frontline staff accounts and was a barrier to acceptance because of the uncertainty it provoked.

For some participants, the uncertainty around why to use telehealth was intensified by the mixed research evidence about its cost and clinical effectiveness and the lack of clarity reported in all the sites about the rationale for investing in remote monitoring, both at the national and at local levels. This led certain participants to question motives and this, combined with the limited knowledge about how to use telehealth successfully, meant that some nurses were reluctant to refer patients:

> Where's the evidence that either it [telehealth] reduces patients morbidity or that it saves staff time...Is it worth it or are we pushing forward technology and now well this will reduce but actually it's not reducing anything (Community Matron 6, Site C)

Not all participants identified themselves as telehealth sceptics and in all four sites, there were 'local champions'

who were identified as key enablers of adoption through their promotion of telehealth and the support they provided to other staff. Having recognized local champions for the introduction of telehealth also offered staff an important source of information and advice, particularly when initial training was felt to be inadequate, or where deployments lacked a nominated individual with responsibility for overseeing implementation.

Good training for frontline staff was identified as another crucial enabler. However, while many participants reported having initial training from the providers of technology, embedding training through experience was a challenge. Moreover, much of the early training was concerned with the technological aspects of telehealth and participants reported little or no provision that focused specifically on key areas of uncertainty. For example, many nurses were not trained on how to identify suitable patients, how to monitor and triage patients effectively, how long patients should use telehealth for and what the expected benefits and drawbacks might be.

Experiencing and understanding telehealth

In each site, uptake among clinical staff was reported to have been slow and variable, both within and between the different teams involved in using telehealth. There was also evidence of negative and positive experiences in each site, which, participants believed, played a crucial role in shaping opinions about the potential value of monitoring patients remotely. Early positive experiences and the sharing of success were identified as key enablers for staff acceptance, encouraging staff using telehealth to refer other patients and, for those not yet using telehealth, to consider it. Among all frontline staff, success was described in relation to patient benefits and satisfaction, although for some nurses the productivity gains from reduced patient contact was viewed as a measure of success:

> We are being asked to see more patients with no additional resources …. How can we release a little bit of our capacity? Because our capacity is at absolute maximum all the time…I think telehealth helps from that point of view (District Nurse 4, Site A)

Early negative experiences of telehealth were reported to have a long-lasting impact on staff acceptance and the predominant view among participants was that during the early local telehealth pilots, there was very little understanding about what it could offer beyond the technology. This uncertainty was exacerbated further for staff who had not been involved in decisions about procurement, installation or monitoring. There were examples of telehealth being imposed on frontline staff in all sites, with poorly designed targets for use and the wrong patients sometimes being provided with telehealth as a result:

> We had a very tainted experience of telehealth in the main. There was a feeling that because we were being pressurized to put people on that actually we were putting people on who potentially might not actually needed it (Service Manager, Site C)

In addition to the lack of understanding about patient suitability and the practice of monitoring patients remotely, two other factors were reported to contribute to a negative experience. First, equipment limitations caused difficulties obtaining accurate, timely and relevant data with which to monitor patients and second, the absence of established resources for telehealth installation and monitoring created additional tasks for existing staff. The combined impact of these early problems meant that the workload associated with telehealth when compared with usual care was viewed as greater, thereby confirming initial concerns about telehealth and adding to the perceptions among some participants that there would be little or no added value.

Overall, these early pilots failed to instil the trust and confidence required for nursing staff to allow elements of their practice, previously carried out in person, to be delivered remotely. However, in some teams, the sharing of positive experiences and the persistence of champions to learn how to work around the equipment and design issues and drive through service improvements helped to establish trust in remote monitoring. In doing so, community nurses who were reluctant to engage with telehealth were able to learn about the benefits for patients and distinguish between the initial problems and the goals that telehealth could help achieve once these barriers were overcome:

> It's like that tipping point isn't it? Once you've got a few people using it and you've got that experience of using it, then more people will have the confidence in using it because they know they can share that with somebody else (Community Matron 20, Site D)

Working out the technology and service design

The shared learning in each of the case study sites enabled participants to distinguish between the barriers associated with remote monitoring generally from those relating to the specific technology and service design (see Table 3 for key barriers to and facilitators of telehealth adoption). This process helped them to have a better understanding about the practice of delivering care remotely; the main processes involved in the delivery of telehealth; and the design features that would facilitate benefits for patients and

Table 3 Key barriers to and facilitators of telehealth adoption.

Barriers to telehealth adoption
Limited referral routes into telehealth meaning that only patients with high-level needs are normally considered, not all of whom are felt to be suitable for telehealth
Uncertainties about assessing patient suitability and difficulties predicting the impact of telehealth on patient anxiety and self-management
Reservations about using new technologies to deliver patient care and anxieties among some staff about their own technical skills
Staff perceptions that telehealth can increase workload and make planning work more difficult in responding to telehealth alerts
Concerns about the impact of telehealth on nursing roles and uncertainty about responsibility for patients due to the shared delivery of care
Difficulties obtaining accurate, timely and relevant data about patients and in ensuring that data are shared with clinicians and other services supporting patients
The lack of evaluation and assessment of telehealth patients and the mixed published evidence about its clinical and cost effectiveness
The limited options to tailor telehealth to individual patients and the lack of other remote care technologies
The impact of poorly designed pilots and targets for use, which can create a long-lasting reluctance among some staff to re-engage with telehealth
Lack of clarity about telehealth duration and concerns about how to remove telehealth from patients who become reliant on remote monitoring
Limited options for discharging patients who will benefit from continued use of telehealth from nursing caseloads
The impact of other changes affecting community health services, which can mean that telehealth is not always a priority for staff
Lack of a shared vision and rationale for telehealth and no commissioning and strategic ownership for investing in remote care technologies
Facilitators of telehealth adoption
A simple and standard referral process that facilitates individual clinical judgement about patient suitability
A dedicated role to manage or coordinate telehealth implementation and drive forward service improvements
A partnership and flexible approach to service design, which enables emerging barriers experienced by staff to be addressed
Understanding the various goals for telehealth and being able to identify clear objectives for using telehealth with a patient
An externally resourced system for installation, technical support, maintenance and de-installation
An integrated and dedicated clinical system for monitoring and reviewing patients and a flexible and small team approach to delivering triage
Mobile equipment that is easy to use, offers accurate and reliable readings and allows monitoring to be tailored to patient need
An increasing awareness among staff that telehealth can be used as a tool for managing caseloads more efficiently
Clinical and practice-based learning about how to use telehealth more effectively and the sharing of patient benefits and good practice
Accessible and ongoing training for staff about how to select and monitor patients remotely as well as the technological aspects of telehealth
Local clinical champions who promote telehealth, encourage and support staff to refer patients and increase awareness of telehealth
Services who are motivated to use new technologies and integrate telehealth into existing care pathways
Engagement from commissioners and strategic managers, which encourages staff to view telehealth as a long-term investment

higher productivity gains for nursing staff. For participants, gaining insights into shortcomings in service design and technology was an important step towards increased acceptance, as it was sometimes difficult to understand what telehealth could offer while these barriers continued to limit success.

The lack of interoperability between telehealth software and electronic patient recording systems was a fundamental example of this because, in practice, it generated new tasks to share telehealth data with other clinicians via electronic patient records. It also caused concerns about ensuring that the telehealth data entered in a patient's record would provide accurate and relevant information with which to assess patient need. This in turn limited staff acceptance and, for some nurses, dampened their initial enthusiasm about the potential of telehealth to monitor patients efficiently:

> I was quite enthusiastic about it…I thought this was going to be the way forward, you know the future, but then, in experience, it just didn't quite work out as well as I thought it would do (Nurse Specialist 3, Site B)

Although participants described their efforts to work around these limitations, having inadequate technology was believed to prevent telehealth from expanding and there was an identified need in three of the four case study sites to procure newer technology to increase uptake and ensure sustainability. Many participants believed that certain processes in place to support remote monitoring required improvement as well. For example, establishing dedicated roles for the installation processes and provision of technical support and for the daily monitoring and triage of patients were reported to be essential components for successful telehealth. This had been achieved to varying degrees in the

four sites and many participants reported that adoption had increased as a result:

I think the lesson learned is that you don't just buy the boxes and drop them into the pathway without thinking about the repercussions and effect on everything else (Manager A, Site B)

Integrating telehealth into routine care

Increased knowledge about remote monitoring had helped to foster confidence in telehealth among all staff groups and participants were, in the main, enthusiastic about the potential of using new technologies to help deliver patient care. At the same time, staff adoption of telehealth in practice continued to be fragile and fluid, with telehealth still viewed by many as a new technology rather than an important component of service provision. There was also a growing consensus among community matrons and specialist nurses that only a proportion of patients on their caseloads were suitable for remote monitoring and that, for telehealth to expand, referral routes should be opened up for patients with other conditions and with less complex needs:

I still stick with my view that our patients aren't always the right patients to have it. I think the wrong team has been chosen initially. I think it could have been used far better and far more prolifically if we had used it lower down the triangle [with lower need patients] (Community Matron 7, Site B)

In the case study sites, certain clinical teams were beginning to explore how telehealth could be integrated into existing care pathways, to promote a more consistent and equitable use of the technology. However, the human investment and length of time it had taken for the integration of telehealth to become a realistic prospect were evident in all of the sites. The efforts of local champions and other key individuals, in driving forward service improvements and sustaining the momentum and positivity to encourage investment in telehealth from others, was reported to play a significant part:

It's something we've got to continue with and get right and I'm more optimistic now than I've ever been that probably we will because I think we've got people that are probably listening now and people that are a bit more experienced (Nurse Specialist 14, Site A)

Not being able to secure investment for new equipment and service re-design was a key barrier to future integration of telehealth and three sites were still locked into using outdated technology. The absence of a specific commissioning or provider organization with a remit or directive

Table 4 Differing goals for telehealth.

Telehealth goal	Illustrated by staff quotations...
To improve clinical practice	Because I get the readings every day, you can build up a good clear picture of what's normal for your patient so you can see the decline much quicker. (Community Nurse 14, Site D)
To reduce hospital admissions	That patient stayed at home...the chances of keeping that patient at home and not going into the hospital all the time were quite slim and I think the telehealth for him helped and it did highlight when he had a chest infection. (Community Matron 2, Site B)
To improve service efficiency	It's meant that I can have a more structured approach to reviewing patients... So with a small number of patients, it's reduced the need for frequent visiting. (Community Matron 5, Site C)
To meet increasing demand for care	If we increase someone's ramapril, we would bring them back to our clinics 7–10 days after...If we had telehealth to do this, we could free up that clinic slot to be used for someone else. (Nurse Specialist 11, Site C)
To reduce the cost of care	I know in discussions with commissioners...that there is no extra money and if we want to develop our services, we have to show a case that the changes we're making are more cost effective. (Clinical Nurse Lead 15, Site A)
To encourage self-management	It's helped them have confidence to manage their own condition and to help them decide when they needed to take anticipatory medication...and being able to contact me or a GP for advice. (Community Matron 7, Site B)
To improve patient quality of life	You can show the carer or family how to use the machines...that reduces their anxiety about the family member [patient] if they have got something that they can use to just check their health status. (Community Matron 5, Site B)

around remote care technologies also had an impact. The rapid pace at which new telehealth technologies are being developed made it difficult for sites to achieve maximum benefit from the technology now available. The development of new innovations, for example, the use of smart phone technology, was viewed positively by those with the knowledge about what was now on offer, but other frontline staff were unaware of these advances, still viewing telehealth as a box in a patient's home.

Substantiating the experiential knowledge developed at the frontline about the benefits of remote monitoring and providing evidence for the differing goals telehealth could help achieve were identified as a solution to tackle the barriers to securing financial investment for new telehealth technologies. However, continued uncertainties about which patients to target for telehealth and which of the goals should underpin the policies for remote care meant that establishing a shared rationale for investing in telehealth in the sites had not been achieved (see Table 4, which illustrates the various goals identified). Consequently, how to measure success when the goals for using telehealth were unclear was identified as a challenge and an enduring barrier towards building the evidence required to secure future investment and integration of telehealth into routine practice.

Discussion

This study found that frontline staff acceptance of telehealth is fragile and uncertain and hindered by a range of organizational, professional and technological barriers, some of which can be addressed and others that are more difficult to overcome. Staff acceptance was found to vary within and across service settings, shifting temporally, sometimes in a non-linear fashion, as staff experiences of telehealth confirmed or rejected initial perceptions about the value of using telehealth to monitor patients' symptoms. Although this fragility meant that emerging barriers to success could inhibit staff acceptance, the adoption of telehealth, like other new innovations, was found to be 'a process rather than an event, with different concerns being dominant at different stages' (Greenhalgh *et al.* 2004, p. 17). In practice, this process was described as one of trial and error during which staff experimented with different technologies and evolving systems to support telehealth over a period of years, thereby acquiring new knowledge about how to effectively monitor patients remotely.

The important role of clinical learning and practice-based knowledge in increasing adoption of new innovations is a key finding from this study and, as a process, enabled staff to discover for themselves what the benefits might be from using what was still regarded by many as a new innovation. Rogers (2003) argues that 'a technological innovation usually has at least some degree of benefit for its potential adopters, but this advantage is not always clear cut to those intended adopters' (p. 14). In the case of telehealth, this was particularly apparent because of the limited evidence about its successful application and effectiveness (McCartney 2012). In addition to encouraging adoption through the sharing of knowledge and success, the increased understanding about telehealth raised new questions about the future of remote monitoring, drawing attention to some of the enduring barriers to integrating telehealth into existing service provision and the difficulties of identifying patients who will benefit the most.

In accepting telehealth, clinicians are giving up elements of their role, previously delivered in person, to technology, but also to their patients and other frontline staff involved in the monitoring and triage of delivering remote care (Segar *et al.* 2013). Instilling trust and confidence in telehealth among staff was found to be essential for successful adoption. The discordance between expectation and experience of telehealth and the detrimental effect this has on adoption were also recently documented in a survey of Dutch cardiac services (de Vries *et al.* 2013). Experiencing the benefits for patients and their own practice can therefore foster the confidence required for clinicians to adopt telehealth for patient care. Addressing barriers at the outset and allowing staff the time to experiment with telehealth and experience the benefits could be an important feature of service design, potentially helping to reduce continued uncertainties about why to use telehealth and addressing barriers to staff acceptance before they would normally occur in practice.

Unlike other studies, which, as Brewster *et al.* (2013) noted, report on individual pilots or large telehealth experiments designed to examine the likely benefits and drawbacks, this research focused on services that have developed more organically, thereby providing an insight into the circumstances that hinder or enable telehealth to be integrated into practice and adopted by whole teams. The findings from this study were not obscured by the issues associated with the running of a trial or other pilot (Hendy *et al.* 2012), but confirm that many of the barriers and enablers identified from those types of studies are still relevant to deployments of a more incremental and organic design (Brewster *et al.* 2013). Examining the temporal dimension of telehealth implementation has also drawn attention to the barriers that were difficult to overcome in real service

settings and those that continue to present challenges to achieving increased acceptance and adoption among frontline staff.

Limitations

The naturalistic design of the study means that although the sample achieved was adequate, the findings are based on retrospective and somewhat partial accounts of implementation as opposed to exploring this with staff from the point of inception. However, this is to some extent mitigated by ongoing work with the sites as part of the wider study, which demonstrates the validity of the factors identified to influence adoption.

Conclusion

This study adds depth to the current understanding of factors affecting staff acceptance of telehealth (Brewster *et al.* 2013), drawing attention to the fragile and non-linear processes involved in the adoption of complex innovations like telehealth and the key role of experiential learning. The broader context, with industry and policy reacting to the difficulties in realizing the goal to mainstream telehealth technologies (Cruickshank *et al.* 2013), to some degree, mirrors the journey in the case study sites, as they work to overcome the barriers to telehealth implementation only to encounter other, more persistent hurdles.

This study draws attention to the key role of frontline staff in identifying and tackling the barriers to successful adoption of telehealth, and also the effort and time invested by local champions in securing resources for improvements and driving up staff acceptance and adoption. The question therefore remains as to whether the continual efforts at the frontline to secure investment for sustainable deployment of telehealth will succeed, or whether the changing political and technological landscape will bring into play alternative solutions, or indeed alternative goals.

Acknowledgements

The authors thank all participating staff for their time and valuable contributions. The authors also acknowledge Lauren Beaumont and Kinga Sokolowska-Lowrie who conducted some of the participant interviews.

Funding

This study was conducted as part of the Overcoming the Barriers to Mainstreaming Assistive Living Technologies (MALT) research project at the Universities of Sheffield and Leeds, funded by a grant from the Assisted Living Innovation Platform, with support from the Technology Strategy Board and the Economic and Social Research Council.

Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (http://www.icmje.org/ethical_1author.html)]:

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content.

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