Abstract

Background

The safe provision of medicines administration is a fundamental challenge faced in long-term care facilities (LTCFs). Many residents of LTCFs are frail older persons with multiple morbidities, and in addition to polypharmacy, are particularly at risk of harm due to concomitant disease and disability. One potential method to optimise medication safety and facilitate medicines administration within LTCFs is the introduction of technology.

Objective

This paper explores the barriers to long-term sustainability concerning the use of an electronic administration system (eMAR) in LTCFs.

Methods

Fifteen in depth, semi-structured interviews were conducted with LTCF staff (9), eMAR service commissioners (2), members of the implementation team (2) and care home strategy managers (2) across three LTCF sites. The study participants were purposefully sampled and each interview audio-recorded, transcribed verbatim and analysed using Nvivo 11. In addition to interviews, observational notes were taken by the lead researcher from visits to the LCTFs as a form of data collection. The analysis process consisted of a two-stage process of thematic analysis then theoretical mapping.

Results

Barriers identified were split into four main overarching areas: structural, implementation team, system user and operational barriers. The adoption of eMAR within this setting was welcomed by top-level stakeholders, however, LTCF staff displayed concerns over its usability. The lack of co-development and on-going training need highlighted barriers to its sustainability, in addition to risks associated with current legislation. The themes identified throughout the framework highlight challenges faced when exploring the sustainability of eMAR in LTCF.

Conclusions

The use of technology in health care is evolving. Awareness of actors relating to its introduction can have significant impact on success and service sustainability.

Keywords

Long-term care facilities, geriatric care, medicines safety, technology, sustainability, barriers.

Introduction

There are approximately 543,000 older persons living in long term care facilities (LTCF) within the UK [1-4]. LTCF's are commonly known as care homes and generally comprise of two main types; nursing and residential (although many have both). Nursing homes consist of care delivered by registered nurses and residential homes provide supportive care delivered by qualified care assistants. Both types of homes are supported through private and/or public-sector funding. Research suggests residents enter LTCFs in the hope to remain as independent as possible [5]. Current national health goals seek to support independence in LTCFs through various methods: supporting patient centred care, developing new models of health care delivery within LTCFs and placing a large focus on

quality and strong leadership to support better health care [6]. Many LTCFs are linked with community pharmacies for safety in receiving and managing medication. However, one of the main challenges faced in LTCFs is the safe provision of medicines administration [7, 8]. Many of these residents have multiple morbidities and are prescribed an average of nine medications per day, coupled with ageing pharmacodynamic profiles, this increases risks associated with medicines administration [9 10, 11]. The National Institute for Health and Care Excellence (2014) recommends supporting safe medicines administration in LTCFs by focussing on patient centred care, through holistic care delivery and administering the correct medication at the correct time and recording appropriately. Many LTCFs currently use Medicines Administration Record (MAR) sheets to record and support administration of medicines. These are paper based sheets which contain details of the resident and their medication. However, MAR sheets have been linked with medication errors, many associated with stopped medications [12]. The Care Quality Commission and British Geriatric Society have reported that patients who have dementia and living in LTCFs do not get the level of care that they need. Further they suggest that better management of patients' conditions and use of technology, can result in enhanced care for older people and reduce admissions into hospital and better rehabilitation [13].

Electronic administration systems may reduce medication errors. The use of technology as a support tool to reduce medication errors, has been introduced in some LTCFs in the form of an electronic medicines administration system (eMAR) [14]. eMAR is a computerised system which aims to replace the traditional paper medicines administration sheets and provide electronic support for recording medicines' taking and clinical details. The use of information technology in health care is an innovative step in supporting improvements in health care quality and safety [15]. Evidence suggests it can make improvements in areas such as reducing health care costs and medicine errors, by minimising the risk of human error and the introduction of supportive data storage applications for improved stock management [16].

Factors such as lack of engagement by stakeholders can pose a risk to the success of these alternative routes of health care delivery [17].

Sustainability in health care is described as "the ability of the system to produce benefits valued sufficiently by users and stakeholders, to ensure enough resources to continue activities with long term benefits" [18-20]. Historically, sustainability can be perceived as a linear process, after a single injection of funds, the sustainability of a service can then be attained [18, 21]. In reality, a health system is dynamic and many factors can affect the performance, efficiency and survival of a health service [22]. Research suggests that conceptual factors such as investment, context and resources can affect the sustainability of a health system and its ability to deliver services[18]. The non-linearity of sustainability supports the continual process of learning and adaptation aiding the notion of evolution. Therefore sustainability can be perceived as a cyclical process rather than linear [19, 23].

Currently many health systems want to engage with long-term improvement measures to reap the benefits of a sustainable efficient system. However, many services do not survive to produce results of long term benefits [24-26]. This can be perceived as inefficient and uneconomical [19]. Current pressures faced within health care, in particular within financial realms coupled with associated population growth and longevity are resulting in increased demands for services and prioritisation of resources [27].

This paper uses a conceptual framework to support the analysis of qualitative data to explore the barriers to sustainability of the use of eMAR in LTCF settings. The conceptual framework of sustainability was developed on the basis of supporting health researchers to understand different

perspectives and applications to support sustainability of health services [19].The paper seeks to identify and describe the barriers, which affect the sustainability of the use of an eMAR system within LTCF settings. A qualitative case-study evaluation took place during a one-year pilot of eMAR across three LTCFs.

Methods

Theoretical Framework

This study was framed by two analytical approaches. Firstly, an inductive approach using thematic analysis supported initial interpretations and allowed direct emergence of themes from the data [28, 29]. This initial analytical step was crucial to determine underlying motivations and reflect reality of the participants perceptions [30] . In order to gain an understanding and depth of sustainability of this service specifically, a secondary deductive approach was undertaken [29, 31]. A consolidated framework derived from a systematic review of sustainability literature was used to inform a secondary deductive analysis [19]. Each construct present in the framework [19] consisted of key components necessary for sustainability. For the purpose of this study, six key constructs identified in the cited framework was focussed on: (i) demonstrating effectiveness, (ii) monitoring progress over time, (iii) training and capacity building, (iv) stakeholder participation (v) general resources, and (vi) integration with existing programs and policies. These constructs were chosen because they featured in 75% of the cases studied during the development of the consolidated framework[19]. Using a secondary supported analysis to understand and measure sustainability, opened a pathway to examine the perceptions of stakeholders and the importance of them in relation to sustainability. Throughout this research qualitative rigour was strived to be obtained, the researcher reflexively approached the qualitative interpretations which supported the validity of the results .

Study Participants

The study was a service evaluation (as part of a larger study) and therefore ethical approval was not required as advised by the University of Nottingham Research and Ethics Committee. Three LTCFs participated in the pilot testing of eMAR in January 2017. This was part of a funded National Health Service (NHS) England scheme, whereby the LTCFs were selected by eMAR service commissioners. The commissioners are primary care healthcare professionals who are gatekeepers of the investment which supported the pilot. The implementation team provided the equipment and training for implementation. Fifteen stakeholders across the three sites were interviewed (LTCF staff (9), eMAR service commissioners (2), members of the implementation team (2) and care home strategy managers (2). System users are all participants who use the eMAR system. Participants were purposefully sampled. Inclusion criteria consisted of having direct involvement with eMAR from the initial implementation of the pilot until the time point of interviews were conducted.

Data collection

Each participant took part in an in depth, semi-structured interview based on a topic guide derived from literature and prior stakeholder meetings (involving service commissioners and the service implementation team). The topic guide was iteratively developed after each interview to gain further understanding. The interviews took place face to face at the LTCF or over the telephone (if stakeholders were unavailable face to face). Each interview was audio recorded and transcribed verbatim. In addition to the interviews, observational notes were taken by the lead researcher from visits to the LCTFs as a form of data collection. These notes consisted of a general description relating to the buildings, interactions between staff members and the use of eMAR system.

Analysis

A two stage analytical approach was taken. The transcribed audio recordings were inductively thematically analysed using Nvivo® 11. The data was then reanalysed using the emergent themes through a secondary deductive process as discussed previously[32 33]. Theoretical mapping was performed within the research team and was conducted to gain a deeper understanding of the qualitative data, to draw out underlying understandings of the sustainability of the service [28, 30].

Results

Fifteen stakeholders across the three sites were interviewed (LTCF staff (9), eMAR service commissioners (2), members of the implementation team (2) and care home strategy managers (2). Findings are presented in an analytical format supported by the cited consolidated framework. Sustainability in this study is facilitated by six key constructs, presented in a conceptual framework based on that proposed by Lennox et al (Figure 1)[19]. Direct quotes from the interviews were used as evidence of human experience in relation to the inquiry and in support of the thematic analysis [32] Figure 1 outlines four overarching themes found; infrastructural barriers, implementation team barriers, system user barriers and operational barriers.

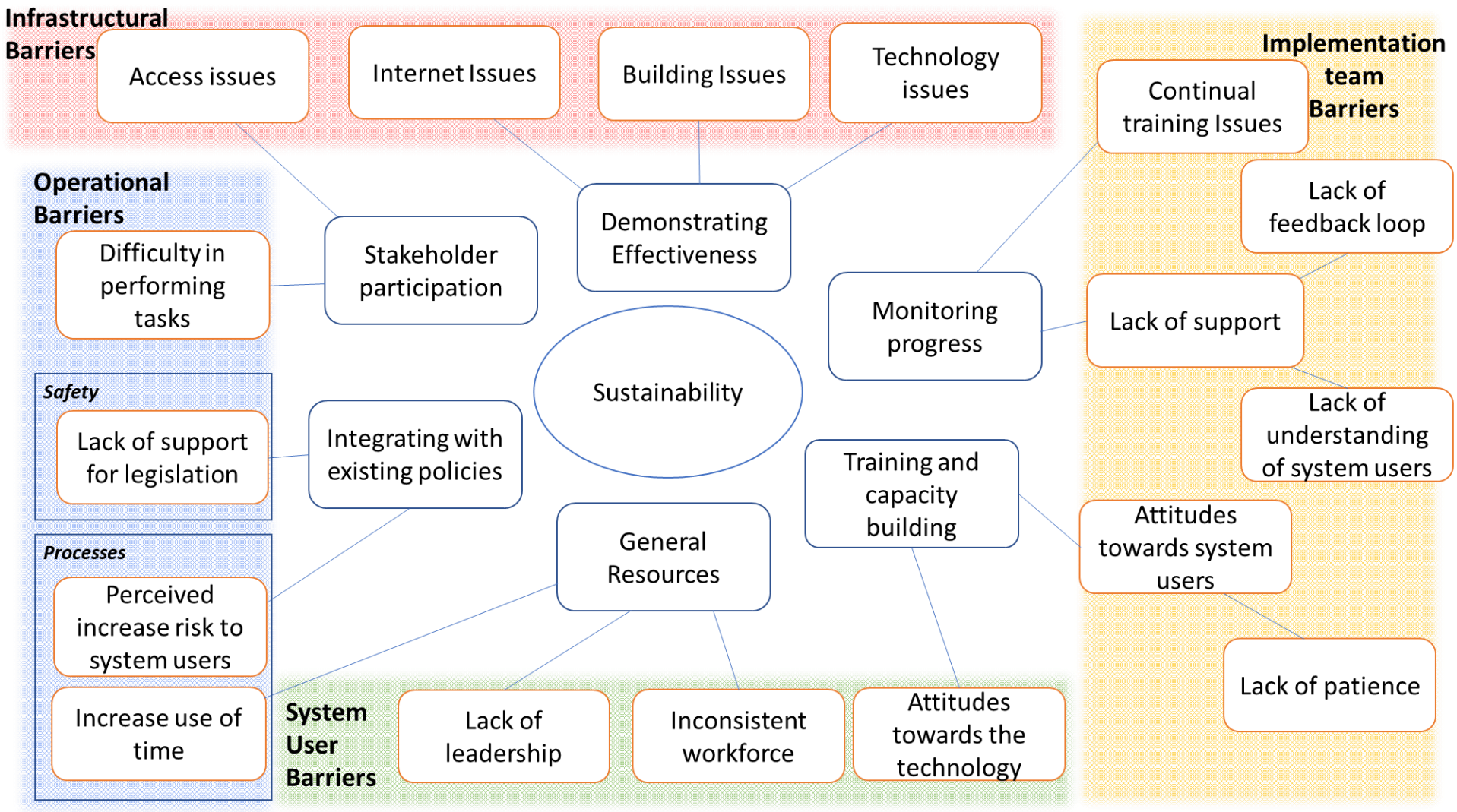

Figure 1 Diagrammatical representation of barriers towards sustainability within three care home settings

Infrastructural Barriers

The structural barriers identified, focussed on the main sustainability area of demonstrating effectiveness to identify and assess whether the technology functioned as it was intended to. System users varied in their views of the technology, some viewed it as a positive introduction, while others were more apprehensive. A common issue was the requirement of needing to run the technology on a wireless network for internet access, which supported users in their cause for concern.

> *"The system works in a purpose built building that is supported with WIFI – has WIFI all over the building. A bespoke care home – as in this one – it doesn't work because WIFI does not support it. So therefore you cannot deliver person centred care with the system." (CH1,LTCF manager)*

LTCF staff and members in the implementation team agreed about this. Due to the building style of the LTCF, a thick stone wall construction of which, the internet signal could not penetrate. The implementation team attempted to rectify these issues by upgrading the wireless network and placing extra access points within the LTCF however, the issues continued throughout the pilot.

> *"To meet the requirements of the system they had to upgrade their internet so the two things that are really dependent on it are speed and WIFI signal within the home. The home is a brick and stone old style building and WIFI wasn't very good." (Implementation team member 1)*

During the implementation process this issue was identified and overcome by alternative offline methods, via syncing information once an internet connection had been established. However, this alternative method of syncing as a perceived solution did not fit in line with the view of "person centred care", as LTCF staff had to run back and forth to the syncing station. This caused feelings of "frustration" and "exhaustion" amongst the LTCF staff These findings suggest that although an alternative route to overcome these barriers had been suggested, it was not discussed with the LTCFs and as a result changed the attitudes of the care staff towards the technology.

Implementation Team Barriers

The implementation team played a vital role within the deployment of eMAR. Key themes which highlighted barriers seen during the pilot can be placed in two key areas (figure 1). An important factor to be considered is, monitoring progress over time, when implementing a new service, because continual support is considered an important tool for successful implementation[19]. Study participants discussed various situations regarding continual support and allowing opportunities for feedback during this monitoring period. The implementation team discussed the importance of a structured timeline and the role of feedback during the pilot.

> *"What we did start doing that was new actually was we started having weekly catch up calls. What we found was that when we went into second cycle data approval and that is where we sign them off we were finding they were having a large amount of missed meds, lots of inconsistencies where actually if we sat down weekly and assessed it ourselves we could as implementers having that weekly phone call setting that expectation that you must have this done, supporting them" (Implementation team member 1)*

Although weekly catch up calls, were perceived as supporting the system users, it became apparent that attitudes and assumptions undertaken by the implementation team had a negative effect on the LTCF team, potentially causing disengagement due to the lack of understanding and miscommunication presented on both sides. One care home manager suggested it was the attitude of an individual implementation team member which caused issues.

> *"But then the problems we have come across we have had somebody else that wasn't (as good) – did talk down to you as though you [were] an idiot. That doesn't help anybody" (CH3, LTCF deputy manager)*

The attitudes of the implementation team towards the system users and lack of understanding of their needs caused a display of negative perspectives from both sides (implementation team and system users). Although feelings experienced by both sides were common knowledge, the implementation team did not change their training to reflect this and provide a more supportive environment. Interviews demonstrated strong attitudes displayed by the implementation team suggests training undertook a didactic approach.

> *"But then saying that when I go in and they have got that attitude but then I explain how the implementation is going to go and I am quite strong willed shall we say... I will drag that person out – not physically let me make that clear! To sit down with them and be like actually the importance of you being here and your understanding." (Implementation team member 1)*

Further exploration of the data suggested one reason for this was due to the age of the LTCF employees. There was a perception of technophobia, assumed by the implementation team and demonstrated by the attitudes of the system users. This coupled with lack of understanding and personalisation, clearly acted as a barrier and prevented any joint resolutions to support the service sustainability.

System User Barriers

Many participants described difficulties when learning a new technology involved in medicines administration, and when coupled with other factors, potentially caused the system users to be part of the barriers to sustainability. This section can be split into three subsections: attitudes towards technology, an inconsistent workforce and lack of leadership.

Throughout the training process discussed above, it can be seen that attitudes of the system users towards the technology were changing. Each hurdle faced caused a comparison to be made between the previous process – paper MAR sheets and the current eMAR system. Attitudes varied between LTCFs and the implementation management team. One participant describes the training as a positive experience, but that the technology itself which was the issue. This attitude precipitated throughout the LTCF team regardless of whether they could use the technology and was noticeable by the implementation team. Disregarding the technology by the team provided a barrier to training for the implementation team.

A structured workforce was demonstrated as an important factor in the data. The lack of and continual variation in staffing throughout the pilot posed difficulty for the training of staff.

> *"There was a lot of pushback which made it very difficult as a trainer when I was trying to teach you something…they also change their management halfway through so their manager left shortly after we started the system and it was the gentleman who was very technophobic." (Implementation team member 1)*

Conversely, on a national scale the introduction of new technology was cited as a solution to common workforce issues presented in the LTCF area.

> *"The system and just generally technology, is the future. There is a big workforce issue out there, you know there are vacancies left right and centre, Brexit[1] is coming up – we don't know what that will*

[1] Brexit "British exit" – The withdrawal of the United Kingdom from the European Union.

mean for registered nurses when it comes to nursing homes so there is a bit of ambiguity there so I would say technology is what the future looks like." (Care home strategy manager 1)

The trainer–system user relationship issues became apparent when interviewing both sides. The training team sought to provide supportive training to the system users. However, an acknowledged barrier to this was lack of consistent leadership. The eMAR system was described to be leader-led and therefore lack of engagement by management teams posed a risk to understanding and sustainability of the system.

"If I go into a care home where the manager doesn't come in for the kick off and doesn't attend any super user training, I see that they have the least attendance on the e-learning prior to implementation, then it shows poor understanding therefore when we do get some pushback it is very much well my staff are seeing this and you said it would be easy but then they don't understand what had led to it." (Implementation team member 1)

Disengagement of LTCF managers suggested a layer of misunderstanding of the technology, leading to sub-optimal use, resulting in a barrier to its implementation and sustainability.

Operational Barriers

This section refers to barriers identified outside of the immediate LTCF staff and implementation team environment. The issue of access refers to access to the technology by members of the health care team who are not involved in working with the system on a daily basis. The implementation team suggested these occasional users were also involved in the early stages of implementation;

"The initial meeting is very much how they [the LTCF] want the system to work for them. For us it is also about our wider engagement so we will talk to stakeholders and anyone else that might come into contact with the care home ...for example district nurses, so they know what the change might look like" (Implementation team manager 2)

However, interviewed occasional users, such as community pharmacists, suggested this was not the case and that they did not have access to support their role in the LTCF setting. The lack of access translated into difficulty for the occasional users to use eMAR data within their clinical rounds, in addition to leaning on the LTCF staff to support them to use the service. This was perceived as a 'waste of time' for the LTCF staff due to removing their focus from their patients. This precipitated friction between LTCF staff and the occasional users.

Figure 1 highlights, time and perceived increased risk to system users within the sub-theme of processes. Data demonstrated time was considered as both a barrier and support when using the new service. One LTCF manager described the additional time it took when using the system, whereas conversely another described the opposite. In depth questioning demonstrated, where the technology had the ability to be used as intended e.g. with reduced infrastructural barriers, it did save time. However, within the LTCF where multiple barriers existed, time was highlighted as an issue which then impacted the undertaking of other tasks within the LTCF.

The perceived increased risk to system users was noteworthy. Stakeholders not involved within the direct implementation of the service suggested this point as a potential barrier to sustainability. Veering away from existing policies and procedures posed an increased risk in the views of the LTCF staff.

"Yes so a big barrier was just reluctance to change from the care homes... The risk in it for them was that things would go wrong and that they would have safety incidents or errors occurring which they previously didn't so the risk of making things worse was a big barrier... perceived barrier." (Service commissioner 1).

This was confirmed by one of the LTCF managers, suggesting the eMAR system does not support staff to adhere to legislation.

> *"We have got legislation that we have to adhere to and when you have got a system that is not syncing and even now when it shows missed medication – it has not been missed but just because the computers haven't synced – I have got to answer as to why that is showing up missed and it's not missed" (CH1 LTCF, manager).*

Financing is considered to be an essential part of mobilising health care services and incentivising providers to support individuals access to health care [34, 35] The service commissioner described the financial incentive needed for this service to be accepted and this acceptance was translated as a success.

Discussion

This paper seeks to explore the barriers to sustainability of an electronic medicines administration system in LTCFs. Four main overarching barriers were identified: structural, implementation team, system user and operational barriers. The themes identified throughout the framework suggest challenges faced when exploring the sustainability of the electronic medicines administration record system in LTCFs. These interpretations should be considered when initiating new technology within a LTCF setting.

Our findings show the initial intention to take up the service was positive and had functions which supported the service-users within their role. Evidence suggests these functions can support users with functionalities such as pharmacological contraindications and reminders [16]. However, a mixture of contextual and organisational factors affected the potential sustainability of this service. The issues relating to structural attributes caused the participants to feel frustrated with the technology, which gave rise to an inherent barrier to the service leading to other contributory factors such as lack of continuity of care. The importance of seamless care and the congruent nature of information technology supported by human factors has been discussed when producing a successful system also known as 'socio-technical systems' [36-38].

Feedback between users and supplier was present throughout the pilot. However, the continual iterative improvement needed to support the service was lacking. This is potentially due to the initial assumptions held by the implementation team and lack of personalisation of the system. Literature suggests this is a common issue as software companies are held to account by only offering 'off the shelf' items with little room for adaptation [39]. These factors lead to organisational issues and impacted the participants need to deliver person centred care and therefore the service did not prove to be effective in this particular setting. Evidence suggests a patient centred focus is key for successful integration of a new service [37].

It became apparent that the trainers held some assumptions when training and this caused potential problems within the trainer-trainee relationship, ultimately leading to the personal disengagement with the technology and issues with learning and progression. Studies suggest, eMAR systems are to be used as tools to support learning and development during the implementation period [40]. Dialogue between the service-users and implementation team may have given better insight into the implementation and continuity pathway of the service.

The findings suggest age was a large barrier to the continual sustainability of the service. The implementation team overcame this barrier through training methods to support older LTCF staff. However, through interpretation of the data it became apparent that the implementation team did not understand the correct 'needs' of the users in order to adapt the training programme effectively.

This ultimately led to lack of understanding of the technology and its usage. Underlying assumptions (not unitedly shared) and lacking an iterative process of development and evaluation supported this barrier [16, 36]. Additionally, this impacted the relationship between the trainer and the trainee causing further barriers to the continuity and uptake of the technology. Understanding the needs of the system users are important to implementation and continual usability [41].

Intermittent users of the system, such as health care professionals had not been trained on the system, therefore it required the LTCF participants to support the multidisciplinary team with access to the MAR sheets. This caused problems with time management and removing the focus of care from the patient, which is imperative in a patient centred setting [37]. This demonstrates one of the problems highlighted within the pilot, a solution to this could be to have joint training incorporating each of the stakeholders involved within the use of the eMAR system.

General resources, such as time, funding, leadership support and workforce all had an impact on the service. As this was a funded pilot financing was not an issue. However, the surrounding costs, such as upgrading the internet and structural changes caused cost implications for the LTCFs. Evidence suggests over 80% of stakeholders from primary care suggested lack of funding as a large barrier to adoption of e-health [16]. Conversely, time was perceived as a LTCF dependent barrier, one LTCF suggested this affected their time greatly while others suggested it saved time. Whilst evidence of using an eMAR system within a secondary care organisation increases time used on medication-related tasks, in this setting it was seen as both a barrier and facilitator [42].

In relation to integrating with existing policies and procedures, the use of new technology within this setting was welcomed by influential stakeholders, such as commissioners and government officials. Care workers on the ground felt that this new technology could compromise their ability to comply with existing regulatory and statutory obligations, although when assessed by commissioners it was deemed a perceived risk rather than actual risk. Literature suggests taking this approach and diverting attention away from how the new technology will impact the organisation and vice versa supports failure[15].

This research highlights potential barriers of implementing an eMAR system within LTCFs. Proposed solutions are essential to overcoming these barriers. Infrastructural barriers are difficult to overcome as they are associated with the LTCF building itself. However, discussing solutions such as offline administration and online uploading with the LTCF staff could better personalise solutions to suit person centred care delivery in each LTCF. The implementation team barriers and system user barriers are heavily focussed around miscommunication. Clear lines of communication are required to enhance understanding of the eMAR system and needs of users to support co-development of the service. This will avoid the development of assumptions and better place implementation and sustainability of the eMAR system. Training of intermittent users, such as those who do not regularly work at the LTCF, was identified as a barrier. Proposed solutions are to jointly train these users with the LTCF staff. As a result, the findings of this study demonstrate areas which should be given careful consideration for future implementation of technologies within these settings. The proposed solutions are essential to successful implementation of eMAR solutions in LTCF. These recommendations are transferable to support the implementation of eMAR in other LTCF settings globally.

Limitations

Due to the research being a case focussed example of a pilot study in three LTCF in one area of the UK the sample size was small and consisted of a small proportion of people involved in the study.

Therefore, themes generated from this study are unlikely to be representative of all LTCFs in the U.K, however, will provide elements of transferability to support implementation of eMAR systems.

Conclusion

Key stakeholders had concerns over the usability of the eMAR; awareness of factors relating to its introduction can have significant impact on success and therefore service sustainability. The adoption of eMAR within this setting was welcomed by local and government level stakeholders; however, LTCF staff displayed concerns over its usability. In terms of international health care systems, it is clear key components such as organisation, socio-technical and implementation are key supportive elements needed to support sustainability. Time and experience are factors, which play a large role in developing attitude towards new technology. The lack of co-development and on-going training needed highlighted barriers to its sustainability, in addition to risks associated with current legislation.

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