Enablers and obstacles to implementing remote monitoring technology in cardiac care: A report from an interactive workshop

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Abstract
An ageing population and chronic disease are putting pressure on the Irish health system. The field of eHealth is rapidly evolving and has the potential to become an important component of healthcare, but there appears to be a gap currently between research in this field and the integration of eHealth technology into clinical practice. During the eHealth Ireland Ecosystem Conference held in April 2018, a workshop was conducted to explore the barriers and facilitators to the adoption of eHealth technology, particularly remote monitoring systems in community and home cardiac care. Participants included clinicians, academic researchers, technologists, patient advocates, policy makers, and representatives from the health service. The conversations in the workshop pivoted around why technology systems in cardiac care rarely moved beyond the research project stage and what can be done to address this issue. The discussions in the workshop focused around the lack of funding available, the need for reimbursement models, the lack of awareness about remote monitoring, the angst about who is responsible for the data generated, the design of systems, regulatory standards, and the increasing demand on services, education, and patient empowerment.

Keywords
cardiac care, eHealth, electronic health, health service, health technology, remote monitoring

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Background

Cardiovascular disease remains the number one cause of death globally with the prevalence ever increasing.\(^1\) While mortality from cardiovascular disease has fallen over recent decades, it still results in 3.9 million deaths per year in Europe and costs the EU economy €210 billion per year.\(^2\) Irish statistics indicate that over 9000 deaths in 2016 were due to cardiovascular disease.\(^3\) Cardiovascular disease is a significant challenge to healthcare, with heart failure particularly burdensome, being one of the most common causes of hospitalisation in people over 65 years of age. In 2008, more than 20,000 patients were admitted to hospital with heart failure in Ireland, 90 per cent of which were emergency admissions.\(^4\) Upon discharge from the hospital, up to 44 per cent of people with heart failure are re-hospitalised.\(^5\) Heart failure costs the Irish State approximately €660 million per year – of which €158 million is a direct cost, corresponding to 1.2 per cent of the total healthcare budget.\(^5\) This substantial burden on the health service is likely to increase with population ageing, improved survival rates from myocardial infarction and more effective treatments for other cardiovascular diseases.\(^6\)

Against this background, eHealth has been presented as a potential solution. The term ‘eHealth’ was coined to describe health services delivery through the Internet and related information and communication technologies.\(^7\) eHealth can include everything from electronic prescribing, online patient scheduling and referral systems to ambient assisted living systems, robotic surgical systems, and wearable sensor systems. Remote monitoring also falls under the eHealth umbrella and is a system that has the potential to deliver specialised care and management to people with heart failure. Remote monitoring involves the use of digital technologies to acquire patient data outside of the traditional clinical environment and these data are then remotely stored (either in a cloud based or remote, physical server) and then accessed and interpreted by a healthcare provider. Remote monitoring can include measurement of physiological parameters (e.g. blood pressure, heart rate, glucose, weight), diet and exercise tracking, medication monitoring, and monitoring for falls.

Much work has been conducted to examine the use of remote monitoring interventions in people with heart failure. Evidence from a recent systematic review suggests that remote monitoring in people with chronic heart failure can be used to identify life-threatening deteriorations and help avoid unnecessary hospitalisations.\(^8\) An overview of systematic reviews of remote monitoring interventions was conducted highlighting a range of diverse remote monitoring interventions such as tele-monitoring, home telehealth, mobile phone-based monitoring, and videoconferencing.\(^9\) This overview concluded that tele-monitoring has beneficial effects on the clinical outcomes of heart failure, including a reduction in mortality, heart failure hospitalisation, and all-cause hospitalisation and an improvement in quality of life.\(^9\) There is a lack of evidence however to support other interventions such as the use of mobile phone-based monitoring and videoconferencing.\(^9\)

Despite the evidence for remote monitoring, there appears to be a gap between research in the field and the integration of services into the care pathway. As is this case in many other new and evolving fields, a huge number of pilot projects begin, and once the project ends, the remote monitoring service is terminated despite its efficacy. The term ‘pilotitis’ has been used to describe these projects that have been successful but do not make it to scale.\(^10\) Many factors are thought to contribute to this phenomenon, with cost, efficiency/workflow issues, lack of technology support/technology gap and privacy/security concerns cited in the literature.\(^11\) A holistic approach has been suggested for the successful implementation of eHealth, including technology, organisation structures, management, economic feasibility, societal impacts, perceptions, user-friendliness, evaluation and evidence, legislation, policy and governance.\(^12\) To understand why this may be the case, the opinions of the most important stakeholders who can influence the implementation and use of healthcare technology in Ireland need to be examined.
eHealth innovations for home and community care conference

On the 11 April 2018, the NetwellCASALA Research Centre for Ageing at Dundalk Institute of Technology (DKIT) hosted the eHealth Ireland Ecosystem conference entitled, eHealth Innovations for Home and Community Care. NetwellCASALA is a multidisciplinary research centre, which undertakes research across a variety of themes, seeking to support and enable older adults to live longer and independently at home. The goal of the eHealth Ireland Ecosystem conference was to explore and consider the challenges and opportunities related to eHealth innovations for home and community care, with presentations from a range of speakers from academia, health service, industry and various community groups represented. The keynote speaker presented on the challenges and opportunities of delivering innovation in healthcare. This event was timely, as the Irish Health Service – the Health Service Executive (HSE) is currently embarking on a major transformation plan. In 2017, the Irish government launched Sláintecare, a new policy initiative, in which a universal primary care delivery model and eHealth were identified as key components to integrated care. In 2018, the Government of Ireland then launched its Sláintecare implementation strategy. However, the strategy lacked detailed information on the amount of funding that would be allocated to eHealth in the years ahead. The strategy focused solely on the development of information and communication technology (ICT) infrastructure and the integration of Electronic Health Records and fails to encompass the entire eHealth landscape. Similarly, the implementation of eHealth programmes in the community is largely dominated by e-prescribing and summary care records with very little focus on telemedicine projects. The implementation of eHealth initiatives, including remote monitoring for older people living at home with multi-morbidities appears to be aspirational.

Collaborative workshop – enablers and obstacles to remote monitoring technology usage in home and community cardiac care

This article reports on a workshop which was designed and facilitated by the authors and took place at the eHealth Ireland Ecosystem conference. This workshop was entitled Enablers and Obstacles to Remote Monitoring Technology Usage in Home and Community Cardiac Care. The aim of this collaborative workshop was to gather an interdisciplinary group of individuals, all with an interest, expertise or experience in healthcare technology and to discuss from their perspective, the reasons why remote monitoring systems have not been adopted in cardiac care by the HSE and or other health service providers, and what can be done to facilitate their adoption. This article reports on the conversations and discussions that arose in this interactive workshop. The participants in the workshop included clinicians, academic researchers, technologists, patient advocates, policy makers, and representatives from the HSE, with the authors facilitating the conversation.

Following a brief welcome and introduction, two broad questions were posed to participants. The questions were as follows:

- Why remote monitoring in cardiac care rarely moves beyond the research project stage?
- How do we solve/challenge this?

Workshop participants broke into two smaller groups and were encouraged to discuss the questions posed. The authors kept written notes during the discussions, and these notes, along with the
responses during the discussions were analysed thematically. A formal consensus process was not used, as the purpose of this exercise was to try to capture as wide a spectrum of responses from participants as possible. Many issues were discussed during the workshop and those which appeared to be most relevant are outlined in the following sections.

**Lack of funding and the need for reimbursement models**

The lack of funding available to integrate new technology into care was highlighted as one of the main reasons why remote monitoring systems have rarely moved beyond the research project stage. In 2018, additional capital funding has been allocated to the HSE, including €60 million specifically for ICT. The total budget for the HSE is estimated to be in the region of €14.5 billion, with 0.41 per cent of this budget designated to ICT. This is much lower than the European average of 2 per cent–3 per cent. However, the funding allocated to ICT has already been committed to the replacement and maintenance of existing infrastructure, meaning there is no financial backing to adopt new systems such as remote monitoring. The lack of funding for basic IT infrastructure is a problem as it stymies the ability of the workforce to integrate with modern IT practices.

To be successful, the introduction of remote monitoring systems would need to include a standard reimbursement process which would require a significant change in policy. However, nations are hesitant to implement these changes. This may be due to lack of scientific evidence on remote monitoring to justify the costs. Therefore, over budgeted healthcare systems are reluctant to provide for reimbursement schemes. In Ireland reimbursement refers primarily to drug payment and long-term illness schemes. Currently, the Health Information and Quality Authority (HIQA) is the only authority permitted to grant or dismiss an application for technological funding based on the grounds of positive health outcomes and low-cost impact/value for money. In 2015, the Irish Government commissioned an assessment of chronic disease self-management interventions. The report included a systemic review which highlighted the greater clinical outcomes achieved with telemedicine in heart failure management. However, despite the positive clinical outcomes and greater cost effectiveness, the report stated this intervention should not be funded, as it was unable to identify the specific component of this intervention which contributes to the improvement of patient care.

To change the status quo, the concerted efforts of all stakeholders involved in the provision of cardiac care is necessary to drive forward the change. In Ireland, the Applied Research for Connected Health Centre was established in 2013 to drive forward technological advances and to provide solutions on the adoption and reimbursement schemes on the use of eHealth. However, a dedicated model to deal with e-reimbursement model for older cardiac patients is still not available.

**Remote monitoring – an unknown entity**

During the workshop, participants spoke about the lack of awareness among health care management and clinical staff, of the opportunities that present with remote monitoring. Workshop participants reported that while there are many examples of pilot studies, implementing remote monitoring systems, management and staff are frequently not aware of their occurrence. While there were no specific examples of this in the literature, the views expressed during the workshop suggested that this is a prevalent case. It was agreed that concerted efforts are required to increase awareness in the general clinical community of the potential that remote monitoring has in cardiac care.
Data responsibilities

During the workshop, the angst that clinicians have about who is responsible for the data collected when using a remote monitoring systems was discussed, and this could be seen as a potential barrier to implementation. Regulation (EU) 2016/679, the General Data Protection Regulation (GDPR) states that the responsibility for any data collected is with the institution that collects and processes it.21 The Data Protection Act 2018 also specifically details the responsibility that institutions have within the Irish State.22 This legislation’s impact is quite broad but puts the institution collecting and processing all data through remote monitoring, in a position of responsibility. The comprehensive nature of GDPR, with the inclusion of historical, written, printed and computer-based storage, means that HSE has a legal imperative, as detailed in the Data Protection Act 2018, to enact the structures and procedures that are needed to control and protect such data.

System design issues

Workshop participants raised the issue of system design, as it was felt that often remote monitoring systems were poorly designed and were not user friendly, particularly for older adult users. Designers of devices and systems should take into consideration older people and their needs, values and experiences so that the interface design should be specifically tailored to them.23 The importance of involving older people in the technology design-making process was also highlighted in the workshop. Interviewing older people to ascertain their needs and preferences regarding design is recommended and this will support and encourage older adults to increase their knowledge and awareness.24

The information fed-back to the user was also discussed as another possible limitation. Participants spoke about how it is often difficult for older adults to make sense of the feedback delivered on some devices. A unified agreement was that patient interfaces should display data in an easy to understand language which older people feel comfortable with. In Ireland, the Universal Design Survey Tool for assessing older people’s use of everyday technologies was developed and recommends that clear, concise and easy to understand language should be used with technology to avoid overloading the older person with information they may not be familiar with.25 Iancu and Iancu26 reported that some older people might experience high levels of anxiety when they are not at ease or familiar with technology. This issue should not be overlooked while aiming to provide ubiquitous eHealth to older adults in Ireland.

Regulatory standards

Workshop participants referred to the lack of understanding of the standards that are being used in the design, production and implementation of the software and hardware that should be used in remote monitoring systems. Standards are an important part of ensuring that the devices that are used to collect data for eHealth applications, are, at a minimum, in compliance with the legal regulations of the countries in which the devices are being used. Regulation (EU) 2017/ 745 is the standard for the creation, oversight and processes used by manufacturers of medical devices within the European Union.27 This regulation states that not only the physical device but also the software used to run the device and process the data collected by the device is also considered a medical device. This standard also differentiates between ‘Wellness Devices’ and ‘Medical Devices’, with wellness devices intended to collect data for general healthy lifestyle and wellbeing monitoring. Medical Devices on the other hand, have had a rigorous quality and risk assessment and have a fully documented development and production process that satisfies the stringent regulations of
(EU) 2017/745 and as such can be used for clinical, therapeutic or medical assessment and they are as accurate as traditional methods of data collection. The standards and processes needed to move pilot studies into the mainstream are available and are being constantly refined, however, to bring such technology forward, it is necessary that all the stakeholders involved are aware that such regulations exist.

**Increased demand on services**

In the workshop, it was suggested that the introduction of remote monitoring in cardiac care could result in increased demand on the health service by identifying more symptomatic patients in need of hospital treatment, and this is seen as a potential barrier to implementation. This indicated that healthcare management were not only aware of remote monitoring technologies but also aware that they may also improve the diagnostic capabilities of the clinicians and increase the lifespan of the population.19 The systematic change detailed in the HSE’s own reports,15 the word states how the overall adoption of these types of technologies is an infrastructural investment that will take several years to implement and will involve a complete overhaul of existing practice, clinically, financially and managerially. This type of change, while integral to the health and future wellbeing of the Irish population, is by its very nature, politically and bureaucratically, difficult to envisage.

**Gathering information**

One of the easiest ways to allay fears regarding any technology or change is to comprehensively inform the policy makers and the proposed adopters (clinicians) of those technologies about what is happening and why. This form of education does not have to be overtly technical, but could use the results of the pilot studies completed to show the benefits that the introduction of remote monitoring can provide, including the reduction of in-patient monitoring, cost reduction after infrastructural build and the empowerment of patients and staff in the management of these conditions in a proactive way. A potential means to overcome this barrier would be to create a repository of past and current eHealth projects that all stakeholders could access in a timely manner. A national repository could act as the first port of call where policy makers, clinicians and indeed service users could access information on the geographical location of projects, equipment used, stage of project, outcomes and if the project was rolled out or not. To date, there is no such initiative in Ireland even though the need was widely suggested in the workshop.

**Education**

Education to address concerns regarding the use of remote monitoring was one of the solutions raised by participants, specifically, educating older people on privacy issues of remote monitoring. There appears to be a dichotomy on privacy and the use of technology among older adults in the literature. Some older adults are very articulate raising their concerns on how technology usage might disrupt their privacy,28 while others are willing to use remote monitoring systems if the outcomes are greater than the disruption of their privacy.29 For example, if remote monitoring allows an older adult to continue to live independently at home, they are not as concerned about privacy issues. A systematic review on home health monitoring technologies30 highlighted how privacy continues to be one of the major concerns for older adults when considering remote monitoring usage. Therefore, educating patients regarding the positive outcomes of remote monitoring was suggested as means to help overcome this challenge. However, the debate remains open regarding
what stage of the remote monitoring process training should be provided, payer (public or private sector) and provider of training.20

**Patient empowerment**

On this matter, there was a collective opinion among workshop participants that older adults should be empowered to engage with technologies for self-management and self-care purposes. Researchers have argued that some older adults with heart failure may not adhere with treatment primarily due to poor health literacy and lack of awareness on their illness and the importance of self-management.31 However, Czaja (2015) posited that healthcare professionals and older adults should work in conjunction encouraging older people to take ownership of their self-care and thus maximise patient compliance. In Scotland for example, cardiac patients utilising remote monitoring reported a decreased attendance to out-patient services, effective accessibility to services;32 and higher self-confidence, responsibility and autonomy because they are active participants in managing their own illness.33

**Discussion and conclusion**

Advances in eHealth technology have the potential to bring about improvements in the delivery of cardiac care. However, in Ireland like many other countries, barriers exist to effectively integrate these into the care pathway. In this article, we have reported on a workshop that was conducted gathering an interdisciplinary group of individuals to discuss the reasons why remote monitoring systems have not been adopted in cardiac care by the HSE and or other health service providers, and what can be done to facilitate their adoption. Diverse opinions were raised in this workshop regarding enablers and obstacles to remote health monitoring implementation. A collective intention of making technological solutions widely available in Ireland was shared by participants. With regard to how to overcome these obstacles, participants posited that education, funding and reimbursement schemes need to be created, and the design of devices should be age friendly and incorporate easy to understand feedback in order to empower older adults to use these systems to self-care. Education and increasing awareness among clinicians about remote monitoring systems that have already been trialled and the expected benefits that they can bring, is vital if we are to move from the present stage of aspirational reporting to a real and meaningful change in the Irish health service. The concerted effort of all stakeholders and political will is now required to bridge the gap between research and the implementation of eHealth initiatives for older people with cardiac conditions in Ireland.

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**Author contributions**

Yohanca Diaz-Skeete, David McQuaid and Oonagh Giggins ran the workshop, collected the data, conceived and designed the analysis and wrote the article. Paul Beaney ran the workshop and peer reviewed the article. All authors contributed to the final article.

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