Exploring How Telephone Triage Nurses Support Older People with Multimorbidity to Engage in Digital Self-management

Patricia McAleer[1(✉)], Julie Doyle[1], and John Dinsmore[2]

[1] NetwellCASALA, Dundalk Institute of Technology, Dundalk, Co Louth, Ireland
patricia.mcaleer@dkit.ie
[2] TCPHI, Trinity College Dublin, Dublin, Ireland

Abstract. In the European Union (EU), 50 million people live with multimorbidity (two or more chronic diseases), which increases in prevalence with age. As a result, a significant burden is placed on those who live with multimorbidity and on health care systems that manage it. Hence, solutions to support people aged 65+ years to self-manage their illnesses are necessary, and digital health technologies hold promise. However, human support may also be necessary, particularly for those managing multiple complex chronic conditions. A nurse-led telephone triage monitoring service offers a potential solution. The aim of this study was to explore the role of a nurse-led telephone triage service in supporting older peoples' engagement with digital health technology. One focus group was conducted via Zoom with three telephone triage nurses (TTNs), and six telephone interviews were conducted with a sub-set of older people with multimorbidity (PwMs). Qualitative data were thematically analysed using Nvivo 12 software. PwMs reported being motivated to engage in self-management by knowing their readings were being monitored. Looking at data over time and observing trends helped the TTNs to make accurate assessments of the PwMs' needs. Both PwMs and TTNs spoke about the warmth of their relationship even though it was conducted remotely. In conclusion, triage nurses play an important role in supporting older people to engage in self-management of multimorbid health conditions.

Keywords: Digital health technology · Multimorbidity · Older people · Telephone Triage Nurse

1 Introduction

With life expectancy increasing exponentially and showing little sign of slowing down [1], the number of older people (people aged 65 years+) is also growing significantly and is forecast to accelerate more quickly in the coming decades [2]. The number of people aged 80 years+ is increasing faster than the number of older people overall. It is estimated that by 2050 this age cohort will number 434 million, tripling the 2015 figure of 125 million [2].

D. Salvi et al. (Eds.): PH 2023, LNICST 572, pp. 244–255, 2024.
https://doi.org/10.1007/978-3-031-59717-6_17

Although one of the greatest achievements of the modern age is the increase in life expectancy, whilst people are living longer, they are not necessarily living *well* for longer [1]. The prevalence of chronic health conditions such as cancer, cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), dementia and diabetes is increasing as a result of an ageing population, and it is asserted that this may become the norm rather than the exception [3]. Multimorbidity is the presence of two or more chronic diseases and it places a large burden on health services who struggle to manage it. The cost of care places a considerable financial burden on EU health services, with €700 billion or 70% to 80% of the total spend on health care being spent on chronic illnesses annually [4]. Further, according to Bähler et al. [5], multimorbidity is associated with twice as many contacts with health care professionals and those contacts increase in number with each additional illness. People with multimorbidity (PwMs) are not only high users of health care resources but are also some of the costliest and most difficult to treat patients, with the cost of care increasing with each additional condition [6].

To alleviate the effects of multimorbidity and hence, to improve health outcomes, PwMs need to engage with the self-management of their illnesses. Barello and Graffigna [7] characterise engagement in health management as being a process in which a fully engaged patient emerges from a series of emotional, cognitive, and behavioural adjustments of their health, and that their success in completing this process depends on how they fared in previous phases of the process. One way that patients can engage effectively with their health and well-being management is through the use of digital health technologies (DHTs). DHTs are shaping the future of health care delivery, driven by the shift towards a knowledge-based economy. The emergence of DHTs has arisen from an urgent need to address the growing burden of chronic diseases [8], Moore's law – the increasingly rapid growth in computer power resulting in the development of smaller and cheaper electronics [9], and finally, health care models becoming more patient focused [10]. Technologies used in health care include email, electronic heath records, clinical decision support software (CDSS), mobile health (m-health) systems (e.g., smartphones, mobile phone apps and tablets), telemedicine (the delivery of medical advice using technology to patients at a distance), wearable devices and monitoring sensors, which play an important role in helping people to make better-informed decisions about their health [11–15].

However, engagement levels with technology-based health interventions are concerning, with limited participation and high attrition rates being common [16, 17]. For example, digital health applications are abandoned by more than 25% of people after only one use which implies that users are not gaining real health benefits from achieving their health goals [18]. Chaudhry et al. [19] reported on an app used by 20 community based older people to set health and wellness goals. Challenges faced by PwMs included time constraints, a lack of technical knowledge and doubts about goal setting. This points to the need to potentially provide support for older people to help them how to use DHTs, e.g., set health goals, input readings, troubleshoot issues, understand their data and know how and when to respond to high readings [19–23]. Moreover, older people when engaging with DHTs face additional difficulties related to the ageing process, with Wilson et al. [24] reporting that age related physical health barriers to technology engagement, such as visual acuity, hearing difficulties and dexterity issues, are prevalent.

Other health problems such as the presence of cognitive impairment can affect attention span, executive functioning and memory, in particular remembering passwords and acquiring new information [22, 25].

Further, older people perceive technology as being impersonal and lacking empathy which results in them feeling little more than a statistic; they lack confidence and the ability required to try new things; and, they also feel the need to retain control over personal information, expressing a lack of trust in sharing that information with others [20]. Another important barrier to engagement with DHTs for older people is the lack of supports, both technical and social, i.e., support received from either HCPs, peers or family members [24]. Difficulties experienced by PwMs in their relationships with their HCPs include limited access to health care, a lack of time during consultations, poor communication between them leaving patients feeling unheard, a lack of trust making it difficult to share information with them, and contradictory information from multiple HCPs leading to a lack in knowledge in how to self-manage [26–29].

One solution to this issue may lie in providing older people with support from a nurse-led telephone triage service. Telephone triage is a procedure in which telephone calls from ill members of the public are received by trained staff who assess and manage the calls by either giving advice or referring them to a more appropriate service [30]. It is a way for people to avoid needless visits to an HCP and to save unnecessary expenditure on health care [31, 32]. According to Vaona et al. [33], telephone triage services have become an integral part of modern medicine with almost a quarter of all care consultations being conducted by telephone. One of the main reasons for implementing such a service is to lessen the burden of care on General Practitioners (GPs) and emergency departments [34]. Jácome et al. [35] found that Telephone Triage Nurses (TTNs) were effective in directing adults aged 65+ years who presented with chronic conditions to a telephone triage service, to the appropriate type of care, thus reducing the overall demand for care.

In this paper, we report on qualitative findings from a study whereby six older people with multimorbidity used a digital health platform, ProACT, to self-manage their health (each of their chronic conditions and related parameters) and well-being (e.g., sleep and physical activity) at home while being monitored and supported by a team of TTNs. The findings reveal the importance of the relationship with the TTNs and its potential impact on PwMs' engagement with the platform.

2 Methods

Semi-structured interviews were conducted with older people (aged 65 years and over) who had two or more of the following conditions: chronic heart disease (CHD); chronic heart failure (CHF), chronic obstructive pulmonary disorder (COPD); diabetes; and, HTN (hypertension) and who had been using the ProACT digital health platform for approximately eight to 10 months as part of a wider clinical programme SMILE (Supporting Multimorbidity self-care through Integration, Learning and e-Health) being coordinated by a clinical triage company. A sub-set of six PwMs from SMILE, as well as three TTNs who provided them with support to manage their conditions were recruited for this PhD project. PwMs were referred to the trial by their respective GPs across three counties in the South-East of Ireland. The TTNs had between 11 and 17 years' experience of working as triage nurses, and also had one year's experience providing triage

support to PwMs in a previous study in which the ProACT CareApp was developed. Due to restrictions imposed by the COVID-19 pandemic, the semi-structured interviews with the PwM participants were conducted by telephone and a semi-structured focus group was conducted over Zoom with the TTNs. The PwMs were asked a series of questions that related to the challenges they faced in managing their conditions, their use of the DHT, their relationships with the TTNs, the supports given to them by the triage nurses and finally, the impacts (if any) of COVID-19 on their self-management and access to health care. The focus group with the TTNs covered topics such as their relationships with the PwMs, the supports they provided to them, the advice given, and how they cared for the PwMs during the COVID-19 pandemic.

At the beginning of the SMILE programme, PwMs were given a suite of digital devices for symptom monitoring depending on their conditions (e.g., blood pressure monitor, blood glucometer, pulse oximeter) as well as a weighing scales and an activity watch for measuring steps and sleep. An iPad with the ProACT CareApp was also provided on which the PwMs could view their symptom readings over time, self-report on their health and well-being, set activity goals and view personalised educational content. Further detail on the ProACT CareApp used by PwMs can be found in [36]. The triage platform used by the TTNs (Sims-triage) is a custom-designed application through which the triage nurses viewed and responded to alerts generated by data collected from the PwMs. In the event of an alert, the TTNs would call the PwMs to check on their health status. These alerts occurred when the thresholds set for different conditions in the system were outside the normal range for the participant. For example, a reading for high blood glucose was anything over 14 mmol/L (which was configured for each participant). The app's dashboard also allowed the nurses to see if alerts were new, under review or resolved. PwMs' health and well-being data were also available, providing the triage team with a holistic picture of the PwMs' health before they called them to discuss an alert. Finally, technical support was provided to the PwMs by the clinical triage company.

All interviews and the focus group were audio recorded and transcribed verbatim. The data were thematically analysed using Nvivo 12 software and followed Braun and Clark's [37] protocol for analysing qualitative data. Ethical approval for the study was obtained by the School of Health and Science Research Ethics Committee at Dundalk Institute of Technology.

3 Findings

Participants were all aged 65 years and over with two or more of the conditions of interest and 60% were male. Five themes were identified relating to the relationship between the PwMs and TTNs and the impact of that relationship on PwMs' engagement with technology. For identification purposes, at the end of PwM participant quotes respondents are identified thus: (ID, age, gender, conditions).

3.1 Supports Provided by the TTNs

The PwMs spoke about the practical supports provided to them by the TTNs, which included getting advice and educational tips about their medications or health conditions

or about when to contact their GP, help with the technology, and monitoring of their readings. They were asked if they always followed the advice given and the majority said they did for reasons such as the triage nurses being professional, having expertise, having knowledge and also because they believed that the advice worked for them: "*Like they're professionals, so they know what they're doing, you know what I mean, what they're saying. If they give me advice on something, I certainly will do it, you know*" (P08, 65, F, CHD + HTN).

Several PwMs said that they would be foolish if they ignored the advice, however one participant reported that she had ignored the advice given about contacting her GP and consequently regretted that decision: "*You know, like when they say to me* '*oh well go to the doctor and get this and do this*' *and I think 'oh well, I won't bother' and then a couple of days later I think that I should have done it when they said it to me*" (P03, 86, F, CHD + COPD).

The TTNs spoke about the approach they took in giving support to the PwMs. They talked about tailoring the advice they gave, according to the person they were dealing with and not taking a 'one-size fits all approach'. Using previous conversations held with the PwMs, knowing about the PwMs' backgrounds, understanding their environmental impacts, looking at the data over time and observing trends were all important in helping them to make accurate assessments of the PwMs' needs. They also spoke about keeping the advice simple so that the PwMs understood it and took it on board: "*It's very gradually bringing it absolutely down to a level of education that you know that they'll understand and take it on board. If you give them too much too quickly, they'll do nothing. It's like baby steps*" (TTN03). The TTNs were asked whether the PwMs always followed their advice. The majority did because they were invested in improving their health and so were willing to take the advice on board. Humour, encouragement and not 'telling the PwM off' were strategies used by the TTNs to prevent the PwMs from ignoring the advice. In cases where the advice was not taken, the triage nurses persisted until the advice was listened to: "*But like I mean as I say we're like a stone in the shoe. We keep ringing you know. There's a lot of very gentle cajoling and you know, and then when they do it, and they do it well, we're full of praise, you know what I mean*" (TTN03).

When asked whether COVID-19 had changed the supports they were giving the PwMs, the TTNs responded that they were giving much more emotional support and reassurance than they had prior to the pandemic: "*Allaying fears isn't it again? It comes back to fear of the unknown, how much was unknown for us all really. The news was always harping on about chronic conditions and chronic conditions. You know that was a difficult thing*" (TTN02). This was because they found the PwMs to be very fearful and anxious. They were also experiencing loneliness and depression because of not being able to see their families, but even after the lockdowns were lifted, the PwMs were isolating themselves from family members through fear of contracting COVID-19. Their advice also changed to advising the PwMs how to keep safe during the pandemic by wearing face masks, proper handwashing and telephoning their GPs first rather than visiting them: "*It was just talking them through good practice, letting them open up again and trying to learn to live with it rather than live in fear all the time, keeping safe at the same time*" (TTN01).

3.2 The Nature of the Relationship

The PwMs appeared to have formed a close bond with the triage nurses, with several of them saying that they felt they knew them, even though they had never met: "*No matter who came on the line I knew who it was. I knew who it was from their voice. I always felt as if I knew them – as friends as well as nurses*" (P01, 78, F, CHD + COPD). The friendliness of the TTNs was commented on by several PwMs who noted that conversations were more than just about health-related matters which they appreciated, with P04 (69, M, COPD + HTN) saying that he "*had craic"* (an Irish slang word for fun) while speaking to them, although he also noted how professional they were in dealing with him: "*They are marvellous. Like, they've done their job with the utmost professionalism all the way down*" (P04, 69, M, COPD + HTN). Finally, P10 (66, M, Diabetes + HTN) reported that he wanted to maintain contact with the nurses after the SMILE project because of the relationship he had built with them.

TTNs shared this perception of the friendliness of their relationship saying: "*I mean we've built up some extraordinary relationships with these people. We haven't even met them, it's phenomenal really*" (TTN01). They spoke about discussing everyday topics such as the PwMs' families or what was happening in their lives, for instance. They felt that it was important to create a holistic relationship because it enabled the PwMs to benefit more from the triage service. The nurses spoke about taking time to talk to the PwMs and the importance of getting to know them on a deeper level. It helped them to 'pick up on cues', something that was vital to treating the PwMs appropriately because they were not dealing with them face-to-face. As one triage nurse noted: "*Our ears are our eyes*" (TTN03).

3.3 The Quality of the Relationship

All PwMs described the TTNs positively, with terms such as 'professional', 'kind', 'caring', 'helpful', 'supportive', and 'encouraging' used throughout the interviews. The PwMs felt confident to be able to contact the TTNs with any issues they had, mentioning that they would do so at any time and as often as they needed, because they did not feel that they were an inconvenience. One participant spoke about the nurses taking the time to talk to him for as long as he needed them, compared to the amount of time afforded to him by his HCPs. The PwMs also felt that they could be open and frank or 'be themselves' with TTNs. For instance, P04 (69, M, COPD + HTN) felt comfortable enough to speak to them if he was feeling depressed:

I did feel that over the period of time, the relationship I built up with the different [nurses], that I could have said anything to them. If I was in the pits of depression here and needed someone, that I could have said 'listen, have you five minutes, I need to talk to someone?' You know I felt that at ease and comfortable with them (P04, 69, M, COPD + HTN).

The TTNs also acknowledged this: "*A lot of them say 'we know you have our backs; we know you're minding us' and that in itself is hugely comforting*" (TTN03). The nurses reported that they had very few difficulties with the PwMs, attributing this to the fact that they had wanted to participate in the project and engaged with it well from the outset. The main issue was needing to be persistent with some PwMs in getting them to attend the GP, something they were reluctant to do because of COVID-19.

3.4 The Important Aspects of the Relationship

The PwMs were asked what they felt were the most important aspects of their relationship with the TTNs. One factor that was mentioned as important for the PwMs was the advice on health issues and being advised on what course of action to take, such as contacting their GP. In fact, one participant P10 (66, M, Diabetes + HTN) stated that he would contact the triage nurses before he contacted his GP or diabetes clinic.

The type and consistency of the contact was also important to the PwMs who felt it important that the nurses were at the end of the telephone and would contact them if there was any issue with their readings: "*Knowing that I can contact them at any time and they can contact me if there's any problems whatsoever*" (P08, 65, F, CHD + HTN). She believed that having this level of contact with the TTNs had increased her confidence in her health and well-being. For P03, (86, F, CHD + COPD), having the triage nurses there to talk to and provide her with advice made a big difference to her well-being given that she was cocooning during COVID-19. P10 (66, M, Diabetes + HTN) felt that being able to communicate with people who were trained and could spot if there was anything wrong was important for him. Further, he also appreciated the amount of time the triage nurses spent advising him, in comparison to the time he was given when visiting his GP.

Being consistent and conveying warmth in their tone of voice when talking to the PwMs was also important to the TTNs because it helped them to build a rapport and consequently develop a high level of trust in their relationship. This was important because occasionally PwMs were afraid or frustrated because of their readings, and it helped to reassure them. Rapport was fundamental to building trust with the PwMs, so that they followed the advice that they were being given. The nurses also spoke about using their conversations as a way of assessing the PwMs' health, which was important for knowing what advice to give:

It's not even just about the chitchat. It allows us to, we use it as an assessment tool as well so you're talking about patients with COPD. They're telling you they're well because they're very fearful of going to the doctors a lot of the time. But in actual fact you know whether or not they're unwell whether they're talking to you in sentences or it's just one-word answers, whereas you know that the last time N03 spoke to them they were full of the chat (TTN01).

3.5 The Role of the TTNs in Supporting Engagement in Self-management

There were several factors which influenced the PwMs' motivation to engage in their self-management, which included their health conditions – P02 (76, M, COPD + Diabetes) for example mentioned his health conditions as the reason he kept engaging with his self-management – and their interactions with the TTNs. The PwMs felt a sense of loyalty to the triage nurses, noting that if they were concerned enough to phone them then they should also engage: "*Well, like when they're going to the bother of ringing me and keeping an eye out, well I have to play my part as well*" (P01, 78, F, CHD + COPD). However, the most frequently mentioned factor to explain their sustained engagement was knowing that the TTNs were monitoring them. In fact, some PwMs perceived that they would not be able to continue using the DHT without the support of the TTNs who were able to help them understand why a reading was high, for example.

Further, PwMs felt that knowing the TTNs were looking at their readings and would phone them if a blood pressure reading was high for example, was motivation for them to take action to avoid it recurring. This would have been by keeping a better watch on their own readings, changing when they were taking them (for example, waiting for a period of time after exercising when their pulse would have returned to normal), or taking a walk. Further, two PwMs mentioned that without being monitored they would not be inclined to take exercise. For others, knowing that they were going to receive a phone call if they did not take their readings was an incentive to do so.

When discussing continued engagement with the technology, a sense of responsibility to the TTNs was acknowledged by P10 (66, M, Diabetes + HTN) who stated that he did not want to let them down as a reason for engaging with his self-management. He felt that the TTNs were a complement to the DHT and they were another reason for sustaining his engagement: "*Without them, I don't know if I would have stuck it out*" (P10, 66, M, Diabetes + HTN).

4 Discussion

There is a proliferation of literature related to PwMs' engagement in the self-management of their health [26, 38–40]. Indeed, in order to achieve better health outcomes, it is imperative that PwMs are successful in the self-management of their multimorbidity. This necessitates them to set priorities and make decisions on a daily basis [41]. It is described in the literature as being an 'iterative process' that requires patients to learn effective techniques to manage their illness, and cope over time through trial and error [42]. This process is viewed as a component of living with chronic conditions within the range of personal, social, spiritual contexts and daily life specific to each person [42]. Yet there is little extant literature related to how older people can be supported to use DHT to self-manage their health with the support of TTNs. Indeed, the type of telephone nurse monitoring described herein was created for the studies detailed here and has not been identified in the literature to the best knowledge of the authors. Hence, this is the first study to examine the phenomenon. It must be noted that the TTNs with their many years working as telephone triage nurses, had acquired listening skills that allowed them to holistically assess patients, taking into account any background cues, illness history, how they were able to respond to questions, and what they weren't saying in order to make informed decisions.

DHT plays an important role in the effective self-management of chronic diseases, having the potential to overcome some of the difficulties patients face in the health care system such as expensive health care which may be difficult to access and poorly synchronised [26, 43]. However, Yardley et al. [44] warn that dropout rates and "non-usage attrition" are higher when there is no human support system in place for users. This factor is also mentioned by Lupton [45] who asserts that the abandonment of wearables for instance, results from a lack of community support as well as users not being provided with what they require. Lupton also posits that issues such as users perceiving their health goals to be unattainable or irritating reminders and alarms also contribute to low engagement rates. Indeed, patients frequently prefer support from their HCP with their self-management, rather than managing their conditions alone [46,

47]. Moreover, Pichon et al. [46] argue that a lack of HCP support can be damaging to the patient. However, HCP support is not always available, for reasons such as time constraints, HCPs feeling burdened by having to monitor patient data, and the conflict between what a patient expects from their HCP and what the HCP can provide [48].

A lack of support from HCPs, family members and friends [24] is one of the barriers that older people face when using technology. Further, having to rely on family who often show a lack of patience and understanding for older relatives trying to learn the technology is far from ideal, and in fact may be a barrier to engagement [49]. Further, Pywell et al. [21] report that a lack of face-to-face engagement is a major deterrent in engagement with technology, and that the absence of interpersonal communication reduces the therapeutic effect of the technology they use. Nevertheless, the findings of this study demonstrate that older people are motivated to use technology to self-manage their health through having the support of the remote TTNs. PwM PwMs on the SMILE study had been engaged in using the technology for between eight and 10 months at the time of interview. This motivation appears to have been driven by the nature and the quality of their relationship which was described as friendly by both the PwMs and the TTNs in spite of the relationship being conducted remotely. Indeed, one participant wanted to remain in contact with the TTNs because of the rapport he had built with them. Further, the PwMs were confident enough in their relationship with the TTNs to feel able to contact them whenever they needed to. They also felt able to open up to the triage nurses in the event of feeling depressed. They perceived that the triage nurses took time to talk to them, something not encountered when dealing with their HCPs. From the TTNs' perspective, getting to know the PwMs by discussing family or life events was a way of creating a holistic relationship which ultimately led to better treatment for the PwMs and enabled them to benefit more from the triage service.

It was important to the PwMs that the TTNs would contact them if their readings were outside their normal range. The level of contact with the triage nurses led to increases in confidence in their health and also relieved their anxiety about their health. In addition, having trained people monitoring their symptoms was important as they could identify if there was anything wrong. The TTNs felt that the high level of trust they had built with the PwMs meant that they had a rapport with them, resulting in the advice they gave being followed. This was important in view of the fact that this research was conducted during the COVID-19 pandemic, when the PwMs were reluctant to attend their GPs.

One of the limitations of the study was the small sample size which makes generalisation of the findings difficult. Another limitation was conducting the interviews by telephone which meant that the PwMs' body language and cues could not be read. However, this method of data collection was made necessary because it took place during the COVID-19 pandemic.

5 Conclusion

This research study contributes to a greater understanding of how PwMs using digital health technologies for health self-management can be supported by TTNs to remain engaged in the process. The findings in this paper are important for future health care service delivery, which aims to decentralise care to the community and support older

adults to better self-manage, given the rapidly ageing global population with health care systems struggling to meet the demand for care. This paper's findings demonstrates that older people will use technology to self-manage their conditions and will keep using it if they have support to do so.

Acknowledgements. Funding for this PhD project was granted by Landscape Funding from the Higher Education Authority, Ireland. This work was part-funded under the SEURO project which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 945449. We would like to sincerely thank all the participants who gave their time to take part in this PhD research project.

References

1. Jagger, C.: Trends in life expectancy and healthy life expectancy. Foresight, Government Office for Science. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/464275/gs-15-13-future-ageing-trends-life-expectancy-er12.pdf. Accessed 15 Apr 2020
2. United Nations, Department of Economic and Social Affairs, Population Division.: World Population Ageing 2015. http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf. Accessed 04 Feb 2020
3. Feather, A.: Managing patients with multimorbidity. Medicine (United Kingdom) **46**(7), 397–401 (2018)
4. European Commission. Digital Agenda for Europe. http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52010DC0245R(01). Accessed 20 Jan 2020
5. Bähler, C., Huber, C.A., Brüngger, B., Reich, O.: Multimorbidity, health care utilization and costs in an elderly community-dwelling population: a claims data base observational study. BMC Health Serv. Res. **15**, 1–12 (2015)
6. Xu, X., Mishra, G.D., Jones, M.: Evidence on multimorbidity from definition to intervention: an overview of systematic reviews. Ageing Res. Rev. **37**, 53–68 (2017)
7. Barello, S., Graffigna, G.: Patient engagement in healthcare: pathways for effective medical decision making. In: Balconi, M. (ed.) Neuropsychological Trends, pp. 53–61. LED, Milan (2015)
8. Bhavnani, S.P., Narula, J., Sengupta, P.P.: Mobile technology and the digitization of healthcare. Eur. Heart J. **37**(18), 1428–1438 (2016)
9. Moore, G.E.: Cramming more components onto integrated circuits. Electronics **38**, 114–117 (1965)
10. Topol, E.J.: Transforming medicine via digital innovation. Sci. Transl. Med. **2**(16) (2010)
11. The American Telemedicine Association. ATA Policy Principles. https://www.americantelemed.org/policy/. Accessed 22 Feb 2020
12. Calthorpe, R.J., Smith, S., Gathercole, K., Smyth, A.R.: Using digital technology for home monitoring, adherence and self-management in cystic fibrosis: a state of the art review. Thorax **75**(1), 72–77 (2020)
13. US Food and Drink Administration. What is Digital Health? https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health. Accessed 14 Sept 2020
14. Fadahunsi, K.P., et al.: Protocol for a systematic review and qualitative synthesis of information quality frameworks in eHealth. BMJ Open **9**(3) (2019)
15. Widmer, R.J., Collins, N.M., Collins, C.S., West, C.P., Lerman, L.O., Lerman, A.: Digital health interventions for the prevention of cardiovascular disease: a systematic review and meta-analysis. Mayo Clin. Proc. **90**(4), 469–480 (2015)

16. Yeager, C.M., Benight, C.C.: If we build it will they come? Issues of engagement with digital health interventions for trauma recovery. mHealth **4**(37) (2018)
17. Lie, S.S., Karlsen, B., Oord, E.R., Graue, M., Oftedal, B.: Dropout from an eHealth intervention for adults with type 2 diabetes: a qualitative study. J. Med. Internet Res. **19**(5), e187 (2017)
18. Todd, G.: App user retention: less than 25% of new App users return the day after first use (here's what to do about it). https://www.braze.com/blog/app-customer-retention-spring-2016-report/. Accessed 14 Mar 2022
19. Chaudhry, B., Dasgupta, D., Chawla, N.: Formative evaluation of a tablet Application to support goal-oriented care in community-dwelling older adults. In: Proceedings of the ACM on Human-Computer Interaction 2022, vol. 6, No. MHCI, Article 208. ACM (2022)
20. O'Reilly, P.M., Harney, O.M., Hogan, M.J., Mitchell, C., McGuire, B.E., Slattery, B.: Chronic pain self-management in middle-aged and older adults: a collective intelligence approach to identifying barriers and user needs in eHealth interventions. Digital Health **8**, 1–15 (2022)
21. Pywell, J., Vijaykumar, S., Dodd, A., Coventry, L.: Barriers to older adults' uptake of mobile-based mental health interventions. Digital Health **6**, 1–15 (2020)
22. Nymberg, V.M., Bolmsjö, B.B., Wolff, M., Calling, S., Gerward, S., Sandberg, M.: Having to learn this so late in our lives: Swedish elderly patients' beliefs, experiences, attitudes and expectations of e-health in primary health care. Scand. J. Prim. Health Care **37**(1), 41–52 (2019)
23. Cajita, M.I., Hodgson, N.A., Lam, K.W., Yoo, S., Han, H.-R.: Facilitators of and barriers to mHealth adoption in older adults with heart failure. CIN (Comput. Inf. Nurs.) **36**(8), 376–382 (2018)
24. Wilson, J., Heinsch, M., Betts, D., Booth, D., Kay-Lamb, F.: Barriers and facilitators to the use of e-health by older adults: a scoping review. BMC Public Health **21** (2021)
25. Borg, J., Lantz, A., Gulliksen, J.: Accessibility to electronic communication for people with cognitive disabilities: a systematic search and review of empirical evidence. Univ. Access Inf. Soc. **14**, 547–562 (2015)
26. Villalobos, N., Serna Vela, F., Morales Hernandez, L.: Digital healthcare intervention to improve self-management for patients with Type 2 diabetes: a scoping review. J. Sci. Innov. Med. **3**(3), 1–11 (2020)
27. Doyle, J., et al.: Managing multimorbidity: identifying design requirements for a digital self-management tool to support older adults with multiple chronic conditions. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI 2019), pp. 1–14. (2019). https://doi.org/10.1145/3290605.3300629. Accessed 30 June 2022
28. Lim, C., et al..: "It just seems outside my health": how patients with chronic conditions perceive communication boundaries with providers. In: Proceedings of the 2016 ACM Conference on Designing Interactive Systems (DIS 2016), pp. 1172–1184 (2016). https://doi.org/10.1145/2901790.2901866. Accessed 03 July 2023
29. Maneze, D., et al.: Multidisciplinary care: experience of patients with complex needs. Aust. J. Prim. Health **20**(1), 20–26 (2012)
30. Mulcahy, D., O'Callaghan, D., Hannigan, A.: Nurse triage in an Irish out-of-hours general practice co-operative. Irish Med. J. (2017)
31. Onubugu, U.D., Earp, J.K.: Telephone nursing practice: how do telenurses perceive their role? J. Best Pract. Health Profess. Diversity: Educ. Res. Policy **6**(1), 891–902 (2013)
32. Andersson Bäck, M.: Conceptions, conflicts and contradictions: in the introduction of a Swedish health call centre. https://pdfs.semanticscholar.org/99fe/161dab171a0e2354476accd6de2268b3261d.pdf. Accessed 10 Mar 2020
33. Vaona, A., Pappas, Y., Grewal, R.S., Ajaz, M., Majeed, A., Car, J.: Training interventions for improving telephone consultation skills in clinicians. Cochrane Datab. Syst. Rev. **2017**(2), 1 (2017)

34. Lake, R., et al.: The quality, safety and governance of telephone triage and advice services - an overview of evidence from systematic reviews. BMC Health Serv. Res. **17**(1) (2017)
35. Jácome, M., Rego, N., Veiga, P.: Potential of a nurse telephone triage line to direct elderly to appropriate health care settings. J. Nurs. Manag. **27**(6), 1275–1284 (2019)
36. Doyle, J., et al.: A digital platform to support self-management of multiple chronic conditions (ProACT): findings in relation to engagement during a one-year proof-of-concept trial. J. Med. Internet Res. **23**(12), e22672 (2021)
37. Braun, V., Clark, V.: Using thematic analysis in psychology. Qual. Res. Psychol. **3**, 77–101 (2006)
38. Yang, H., Du, H.S., Wang, L., Wu, T.: The influence of social support networks on health conditions via user engagement: gender as a moderator. J. Electron. Commer. Res. **20**(1), 35–54 (2019)
39. D'Agostino, T.A., et al.: Promoting patient participation in healthcare interactions through communication skills training: a systematic review. Patient Educ. Couns. **100**(7), 1247–1257 (2017)
40. Ibe, C., et al.: Intensity of exposure to a patient activation intervention and patient engagement in medical visit communication. Patient Educ. Couns. **100**(7), 1258–2167 (2017)
41. Bratzke, L.C., Muehrer, R.J., Kehl, K.A., Lee, K.S., Ward, E.C., Kwekkeboom, K.L.: Self-management priority setting and decision-making in adults with multimorbidity: a narrative review of literature. Int. J. Nurs. Stud. **52**, 744–755 (2015)
42. Miller, W.R., Lasiter, S., Bartlett Ellis, R., Buelow, J.M.: Chronic disease self-management: a hybrid concept analysis. Nurs. Outlook **63**(2), 154–161 (2015)
43. Chien, I., et al.: A machine learning approach to understanding patterns of engagement with internet-delivered mental health interventions. JAMA Netw. Open **3**(7), e2010791 (2021)
44. Yardley, L., et al.: Understanding and promoting effective engagement with digital behavior change interventions. Am. J. Prev. Med. **51**(5), 833–842 (2016)
45. Lupton, D.: Wearable devices: sociotechnical imaginaries and agential capacities. In: Pedersen, I., Iliadis, A. (eds.) Embodied Computing: Wearables, Implantables, Embeddables, Ingestibles, pp. 49–70. The MIT Press, Cambridge, MA (2020)
46. Pichon, A., Horan, E., Massey, B., Schiffer, K., Bakken, S., Mamykina, L.: Divided we stand: the collaborative work of patients and providers in an enigmatic chronic disease. Proc. ACM Hum.-Comput. Interact. **4**(CSCW3), 1–24 (2021). https://doi.org/10.1145/3434170. Accessed 03 July 2023
47. Chewning, B., Bylund, C.L., Shah, B., Arora, N.K., Gueguen, J.A., Makoul, G.: Patient preferences for shared decisions: a systematic review. Patient Educ. Counsel. **86**(1), 9–12 (2012)
48. Doyle, J., et al.: The role of phone-based triage nurses in supporting older adults with multimorbidity to digitally self-manage – findings from the ProACT proof-of-concept study. Digital Health **8**, 1–17 (2022)
49. Zibrik, L., Khan, S., Bangar, N., Stacy, E., Novak Lauscher, H., Ho, K.: Patient and community centered eHealth: exploring eHealth barriers and facilitators for chronic disease self-management within British Columbia's immigrant Chinese and Punjabi seniors. Health Policy Technol. **4**(4), 348–356 (2015)