

Ageing and Medication Adherence: An Overview of Key Challenges, Technologies, and Opportunities

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ABSTRACT

A growing ageing population and the rise in the number of people living with long-term conditions lead to increasing demand for resources to support healthcare in a pandemic impacted world. Medication self-management or adherence remains a major challenge that creates additional pressure on the global healthcare system. Poor medication management puts the patients at risk of poor health outcomes, increased mortality and burden on the National Health Service (NHS) in the United Kingdom. In this paper, the authors provide an overview of medication adherence and discuss its underlying challenges and emerging opportunities in the smart packaging sector. This includes exploring the relevant challenges for older people's medication self-management through interviews with medical experts. Finally, conclusions and an outlook are presented towards future opportunities for personalized product-service systems of the future.

Keywords: Ageing, In-home healthcare, Medication adherence, Personalization

INTRODUCTION

Over two million people age 65 overtake at least seven prescribed medicines per day. In addition, people with chronic and long-term conditions are increasingly multi medicated, and 50% of those fail to adhere to their medication (World Health Organisation, 2020). One problem with care at home is the patient's ability to take vital medications at required times. Forgetfulness, adverse effects, cost of treatments, and lack of familial and social support and care are all reasons why patients may be non-compliant with their medications (Shruthi et al., 2016). As a response, many countries are increasing the proportion of in-home healthcare with a vision to move routine medical checks and other healthcare services from hospital to the home environment to reduce the total expenditure on medical care or treatment. This transformation is creating new opportunities to increase patients' independence and sustain their self-management through in-home healthcare (Thuemmler, 2017). This paper explores the role of digital technologies in healthcare

and the key challenges of medication adherence among older people in in-home healthcare. The results from semi-structured interviews with medical experts are presented and discuss future research opportunities to enhance medication self-management for older people.

DIGITIZATION IN HEALTHCARE

In 2018, 11.9 million residents in Great Britain were considered elderly, representing 18% of the total population while increasingly multi-medicated with long-term conditions (Office for National Statistics, 2019). The COVID-19 pandemic highlights the importance of in-home healthcare for the ageing population. The older population and clinically vulnerable individuals are told to shield and isolate themselves from the public. While this became the new normal for many, a selected few have always had primary and secondary care restrictions due to living in remote areas (Myrvang and Rosenlund, 2007). There has also been an increase in the number of patients who have a new post-pandemic lifestyle, limiting unnecessary contact and replacing previously face-to-face meetings with virtual ones. Also, patients are less inclined to visit overcrowded waiting rooms for routine appointments which can be conducted virtually. These factors are further accentuated by the ever-increasing centralization of specialist secondary care services and the ageing population. While research is limited, as digital health is a relatively new concept, several studies have included dermatologists using successful video consultations and distant diagnosing via videoconference sessions during weekly meetings between consultants and general practitioners. Digital healthcare is not without its downfalls. One of the most common concerns with the technology is that patients of an older age may struggle to comply with the technology, depending on their level of technology literacies (Karen Taylor, 2015). Another complication with homecare is that it is not always covered by the NHS, meaning many people may not afford it. While grants are available, they are often limited, challenging to apply for, and the process is lengthy, meaning most people who would benefit from in-home care do not receive it (Oliver et al., 2019). As general technology use within older people continues to grow, it is possible more of the older generation will turn to technology to improve their quality of life, which could include technology-based in-home care (Bause, Melania et al., 2019). Increasing an individual's technology use could improve their quality of life and life expectancy, as social isolation or loneliness in older adults is associated with a 50% increased risk of developing dementia, a 30% increased risk of coronary artery disease or stroke, and a 26% increased risk of all-cause mortality (Donovan and Blazer, 2020). There is an indication that in-home healthcare for the older population enabled by smart packaging will address the negative trend in medicine adherence, helping to bridge the gap between healthcare professionals and patients.

METHOD

Interviews

Individual interviews were conducted with five medical experts based on their extensive experience with older people, specifically their care at home. In

Table 1. Participants information.

Participants	Current Job Title	Expertise and Level of Decision-Making	Experience working with older people	Average age	Gender
A	Commissioning Manager	Physical & Cognitive Regional	20+	42-47	Male
B	Frailty Practitioner	Physical Hospital	23	45-50	Female
C	Specialist Occupational Therapist	Physical & Cognitive Hospital and community	13	35-40	Female
D	Community Physiotherapist	Cognitive Hospital and community	23	45-50	Male
E	Physiotherapist and therapy team lead	Physical Hospital	15	37-42	Female

addition, their experience range across the medical hierarchy, ranging from treating patients at home daily to managers helping make decisions for the in-home care of the older people among all genders and LBGT+ members. The interviews were semi-structured, with open-ended questions, allowing the interviewees to state their opinions concerning the challenges of medication self-management at home and in-home healthcare needs. The following table illustrates the participants' demographics and expertise anonymously by dedicating them to alphabet letters.

Further, the interview questions were centered on two key themes, age-specific limitations and condition-specific limitations with in-home healthcare older people are facing and identifying how digital technology and pill dispensers could improve medication adherence.

RESULTS

The key themes that emerged from the collected data highlight the need for personalized solutions for end-users with a diverse range of needs. The results from interviews with experts indicated the key challenges older people face with their medication management based on age-related needs and condition-specific needs. The key challenges include reduced dexterity, motor skills, forgetfulness which can often be impacted by age-related conditions such as Alzheimer's and increased risk of falls. Also, the age-related challenges manifest as an inability to open a medicine package and take pills or to recall and organize medicine intake on their own. The second key theme that emerged from the collected data highlight the condition-specific needs related to sensory impairments (blindness or deafness), neurological conditions (Alzheimer disease, and due to Covid-19 and associated restrictions

social isolation (mental health, loneliness). Interviewed experts consider digital technologies for medication management such as Alexa, Medibox, and Medipack to be useful in medicine recall, medicine management, reducing exposure to health risks in the hospitals, and reducing social isolation. However, they said the existing technologies “designed by young people for young people” are not suitable for heterogeneous older populations facing different age and condition-related challenges living under complex medicine regimes. The results of this study identified personalization and accessibility as a key to the success of a design solution that would enhance medication adherence.

The experts said digital health technologies for in-home healthcare are mainly IoT based predominantly connected with wearables such as mobile phones, tablets, and wearables such as Apple Watch, Fitbit, etc. Only users at a high activation level in terms of knowledge, skills and confidence can efficiently use these devices to manage their health. However, older people at lower activation levels consider these devices overwhelming, leading to poor outcomes and high costs for their health self-management. In addition, there is a need for simplicity in every factor of the product so that despite having given medical conditions, patients would be able to access and take medication without confusion or in a laborious manner. This is vital to ensure the safety of the patient regarding time-sensitive medications. Current medical devices such as pill dispensers are not designed to support different users’ complex medicine regimes and habits. Therefore, medical experts believe that the personalization of digital technologies will also allow for tailor-made solutions for individual needs, much needed for patients’ memory complications where an unfamiliar voice may not be as effective compared to a familiar one.

Many products do not consider the fundamental needs of older people when using pillboxes. However, as stated by medical experts, smart packaging could aid older people and improve their engagement and independence. Some common issues reported is that current products are too fiddly or small, especially as older people have reduced dexterity, such as those who have arthritis. Lettering is often too small to be read by people with visual struggles. In addition, the color of pillboxes is all very similar, which can be extremely difficult for people with certain neurological conditions, such as dementia. It is suggested that a simple solution is to have parts of a product in different bold colors, such as red and white, to help differentiate the components. Medical experts also expressed the need for affordable solutions for retired people who went lower in their economic status and accessible to avoid the pockets of deprivation.

The final take of the interviewees on newly designed digital health technologies is optimistic. In their opinion, these technologies would become common in in-home healthcare for medicine adherence, bridging the gap between patients, their informal caretakers such as their family members or close friends, and their formal caretakers.

CONCLUSION

The results identified a diverse range of user needs that are not aligned with existing pillboxes for medication management of older people. The users

need to be educated about the medicine they take and drug interactions prior to use. Also, proper education from doctors and strong support from their informal or formal caretakers is crucial in how compliant the older people are with their medication instructions. Digital methods such as mobile apps, email, text messages, automatic phone calls or smart packages should be integrated with the in-home healthcare system to communicate with patient-/service users. In addition, smart packaging needs to monitor the state of the medicine and its intake, communicate with the patient when to take medication, and assist by communicating underuse or overuse to informal/formal caretakers and doctors. Since the older population is heterogeneous, the issue of medicine nonadherence needs to be approached individually based on patients physical and cognitive abilities, knowledge and digital fluency, behavior, attitude, habits and beliefs, and chronic conditions. In this interview study, it is identified that there is a need for further investigation of the context-sensitive design of personalized products, services and systems for older peoples' medication self-management to enhance independence and medication adherence.

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