Exploring the Potential of Social Robots in Supporting Home Medication Management

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Taking medications as prescribed can be difficult, especially for older adults who often need to remember multiple doses. While technology and other interventions exist to help people and their caregivers with medication management, most of them are unreliable when dealing with complex medication regimens. Previous research shows that robots could provide reminders as well as social and emotional support, offering a promising alternative for assisting both older adults living independently and caregivers helping them manage complex medication regimens. In this paper, we explore how social robots could support home-based medication management. We present the results of 6 workshops conducted with 10 informal and 8 formal caregivers, and 10 interviews conducted with older adults to further understand their experiences and challenges with medication management and the potential role of robots to support them. We identify tensions between practical challenges of keeping robots in home settings (e.g., maintenance, cost) and their potential benefits supporting both older adults and caregivers (e.g., providing medication and emotional support, and monitoring patients). Based on our findings, we provide discuss several implications for the design of social robots that need to be taken into account before deploying robots in home settings.

Medication management, Social robots, Older adults, Formal caregivers, Informal caregivers.

1. INTRODUCTION

Medication non-adherence, i.e., patients not taking medications as prescribed, is a significant public health problem. It poses serious challenges to both patients and healthcare providers, leading to compromised treatment outcomes, increased healthcare costs, and a higher risk of adverse health events (Louisa Petchey 2019). Several technologies have been implemented to make medication management easier for people who live independently, including: app reminders (Stawarz et al. 2014; Verdezoto and Wolff Olsen 2012), automatic pill dispensers (Mugisha et al. 2017), electronic pillboxes (Cutler and Everett 2010), smart pillboxes (Abbey et al. 2012) and Electronic Medication Management Systems (EMMS) (Aldeer and Martin 2017). While these solutions can support people who forget to keep track of their medications, they have limitations. For instance, a study found three main issues reported by older adult users of medication management apps: difficulty navigating in the app, poor visibility, and lack of transparency Stuck et al. (2017).

Novel and emerging technologies have also been used to support medication management at home,

including robots, smart home systems, Virtual (VR), chatbots, or voice assistants (Palanica et al. 2019; Prakash et al. 2013). Social robots (defined as "embedded systems designed to interact with humans"; Duffy et al. 1999) in particular have shown the potential to be acceptable and useful in older adults' homes (Leung et al. 2022). They offer a diverse range of functions and have been used to support rehabilitation (Feingold-Polak et al. 2021), help reduce loneliness in older adults in institutional settings (Robinson et al. 2013), and promote weight loss and healthy behavior (Kidd 2008). Prior research suggests that older adults are open to robot assistance to support medication management (Stegner et al. 2023). However, their preferences regarding medication management can differ depending on the nature of medication related tasks (Prakash et al. 2013). Although robots can be used to remind about medications, older adults tend to prefer human assistance when deciding which medications to take and when, due to their concerns about fully relying on robot and the chances it can make mistakes with their medications (Prakash et al. 2013). Nevertheless, the use of social robots in the context of medication management is limited. Thus, there is a need to further understand the

challenges and opportunities using such robots in home settings.

To gain insights into how social robots could support medication management, we conducted a series of workshops involving 10 informal and 8 formal caregivers, and individual interviews with 10 older adults. We sought to better understand the challenges associated with the use of robots in home settings, as well as the potential benefits they offer to older adults and caregivers. We found that robots can indeed offer great potential to assist both older adults and caregivers in their medication related tasks. However, to be able to reach this potential, some practical challenges need to be addressed before robots can be safely deployed in home settings, including their maintenance, cost and finding a place in the home for the robot. Our work expands the understanding of how social robots can be integrated into medication management practices and identifies tensions that exist between the potential benefits and practical challenges of social robots at home.

2. BACKGROUND

2.1. Older Adults Challenges of Medication Management in Home Settings

Older adults face several challenges related to medication management in home settings. Their adherence to medication regimens can be influenced by various factors, including their age, health condition (both mental and physical), personal beliefs about their illness and medications, and the side effects of medications they are taking (Chia et al. 2006; Emadi et al. 2022; Félix and Henriques 2021; Jessop and Rutter 2003; Mahmoodi et al. 2019). Furthermore, whether older adults take medications or not depends on the perceived benefits and necessity of treatments, patient-practitioner relationships, financial constraints, and the number of medications and complexity of their regimen (Mukhtar et al. 2014). Older adults can also be non-adherent due to their physical limitations, such as not being able to reach or swallow their medications, or due to their forgetfulness (Boron et al. 2013). These factors can result in confusion regarding medication instructions, intentional skipping or incorrect dosing, and ultimately make medication management more challenging for older adults and their caregivers.

As caregivers are directly involved in supporting older adult's medication management, they also face multiple challenges. For example, if older adults have severe medical problems (e.g., mental health issues or cognitive disabilities), it puts more pressure and burden on the caregivers, especially informal caregivers (e.g., family members) (Beals et al. 2006). For example, the caregivers of people with Anosognosia, a specific condition where a person cannot perceive their mental condition, have greater difficulty in providing pharmacological and non-pharmacological treatment (Starkstein 2014). Hence, caregivers need to be careful when helping people who cannot longer take care of their own medications and need extra support to perform caregiving activities at home (Kulkarni et al. 2008).

2.2. Social Robots for Health Care Support

Robots have demonstrated their use in various domains, such as education (Bravo Perucho and Alimardani 2023), storytelling (Wang et al. 2022), and health care support (Anson et al. 2023) including rehabilitation (Giansanti 2021). For example, a robot prototype has been created to understand how to support reminding and scheduling practices of people with brain injury and cognitive disabilities who live in a nursing home (Krummheuer et al. 2019). In addition, robots have not only been used to support older adults in their homes as they can communicate verbally and non-verbally with them (Wu et al. 2013), but they can also keep older adults entertained when they experience loneliness and social isolation (Broekens et al. 2009). Previous research shows that when a robot has a physical form and resembles a human or a object, users tend to find it more enjoyable and relatable (Laban et al. 2022). For example, PARO, a social robot specifically designed for therapeutic support, has proven effective at meeting the socio-emotional needs of older adults in the nursing home settings (McGlynn et al. 2014).

In the context of medication management, social robots offer new possibilities as alternative solutions to traditional systems. One advantage is the potential for a robot's presence to positively influence people's behavior (Lee et al. 2006). Previous research has demonstrated that the physical presence, embodiment, and appearance of robots can enhance user acceptability (Li 2015; Fischer et al. 2012; Slyper and Hodgins 2012). In a study conducted by Broadbent et al. (2014), robots such as IrobiQ and Cafero were placed in care homes to serve as medication reminders for older adults. The researchers found that 15 out of 29 study participants perceived these robots as useful, acceptable, and even formed a friendly connection with them. However, the other half expressed their lack of interest in having a robot companion for medication reminders. The reasons provided by this group included being frequently out, not perceiving the need for a reminder, limited space in their homes, confidence in remembering medications without assistance, perceiving the robot as not offering any additional benefits, requiring time to get used to

it, difficulty in moving or switching off the robot, and the desire for more features. Despite these mixed responses, further investigation is needed to better understand the practical considerations of implementing the robots at home for medication management.

According to previous research, social robots have the potential to act as caregivers for independently living older adults (Datta et al. 2011) and support caregiving tasks when caregivers are not physically present. There is limited understanding of caregivers' perspectives when it comes to developing robotic applications in the healthcare context, particularly in supporting medication adherence. It is also important that older adults and caregivers develop trust in social robots (Giorgi et al. 2023; Sivaraman et al. 2023; Zafrani et al. 2023). Trust is traditionally defined as the belief that an agent will assist individuals in achieving their goals in uncertain and vulnerable situations (Piasek and Wieczorowska-Tobis 2018).

Previous research has highlighted potential trust barriers towards robots, which are influenced by various factors such as the robots' performance, characteristics, abilities, and attitudes (Hancock et al. 2021). However, social robots can help overcome these barriers by offering acceptable recommendations for dealing with medication-related issues, being non-assertive and allowing humans to take the lead (Calisto et al. 2023; Niemelä et al. 2021), and actively contributing to building trust (Giorgi et al. 2023). In this study, our aim was to gather older adults' and caregivers' opinions, perspectives and expectations related to the use of social robots as tools to support medication management, and to identify the potential design challenges and factors that are important to consider when deploying robots in older adult's home.

3. METHODS

We conducted a series of workshops and interviews to understand older adults' and caregivers' perspectives and expectations related to the use of social robots as tools to support medication management. The study also aimed to identify potential design challenges and factors that are important to consider when deploying robots in older adults' homes.

3.1. Participants and Recruitment

We recruited 28 participants: 10 older adults, 10 informal caregivers (family members) and 8 formal caregivers (doctors, nurses). All older adults (2 men and 8 women) were aged 55 years or older and were taking regular medications. Informal caregivers (8 men and 2 women) had experience of caring for

their parents with medical conditions (e.g. cancer, diabetes, fractures, paralysis), while 2 informal caregivers provided medications to their children. Formal caregivers (1 man and 7 women) worked as hospital nurses and practitioner doctors, and had between 6 months to 8 years experience providing care. Participants were recruited amongst the staff and students of the authors' institution (through mailing lists) and amongst general public (through social media and posters in libraries, community centres, pharmacies, etc). The study received a favourable ethical opinion from the School's Research Ethics Committee.

3.2. Procedures

We conducted 10 individual interviews with older adults and 6 workshops with a total of 18 caregivers. Each caregiver workshop was attended by 2-5 participants (see Table 1). Additional information about the workshops and participants are presented in the Appendix.

Workshop session	No. of participants
W1	3 (3 informal caregivers)
W2	4 (4 informal caregivers)
W3	4 (2 informal caregivers, 2 formal caregivers)
W4	3 (1 informal caregivers, 2 formal caregivers)
W5	2 (2 formal caregivers)
W6	2 (2 formal caregivers)

Table 1: Caregiver workshop details

Participants signed a consent form and read the participant information sheet before the sessions. All interviews and workshops took place online because of Covid19 restrictions and lasted approx. 60-90 minutes. Each session started with a short presentation about the causes of poor medication adherence. The goal was to show the current challenges presented in the literature and discuss whether they were relatable. It helped participants to establish a common understanding of the problem and brainstorm their ideas to identify potential solutions. Next, we asked older adults about their own experiences and struggles with taking their medications, whereas caregivers were asked about their experiences and struggles with providing medications. To facilitate the discussion about the potential use of social robots, we showed a video of an older adult interacting with a robot that was

reminding them about their medications[1]. Similar to previous research Kanda et al. (2012), this video was chosen to help participants envision a medication reminder robot in a home setting. Next, the participants were asked about the possibilities of using social robots to support medication management at home for both older adults and caregivers. We finished the sessions with questions about the ethical concerns, and acceptable and unacceptable types of human-robot interactions. Two informal caregiver participants were not comfortable discussing robots at home in front of others and instead submitted their thoughts through an online questionnaire we provided after the session. All participants received £10 shopping vouchers.

3.3. Data Analysis

Each session was recorded and transcribed. The transcripts were analysed using both top-down and bottom-up thematic analysis approaches (Braun and Clarke 2006). Our top-down approach was informed by relevant previous literature with predefined discussion categories, including older adults experiences with medication management, technologies that older adults and caregivers have used, their suggestions for a medication management robot, and the impact of having a robot at home (Mukhtar et al. 2014; Granger and Bosworth 2011; Leung et al. 2022). Second round of analysis helped us identify the trends related to the robot's use as a monitoring device for older adults, the problems these robots can encounter when used in older adults' homes, and how older adults perceive the robots in general. At the same time, bottom-up approach helped to identify new categories such as trends, challenges and other opportunities for social robots beyond medication support. The initial coding was done by the first author and discussed with a senior co-author with expertise in qualitative analysis. *QDA miner lite* and *Nvivo* software were used to code, annotate, and analyse the transcripts. After the coding was finished, similar codes were merged and grouped under the same theme. The themes were then discussed with other members of the research team, and the analysis continued as part of writing the manuscript. In the end we identified three major themes that are presented below.

4. RESULTS

4.1. Social Robots as Monitoring Devices

When asked how robots could help with medication management, caregiver participants suggested various monitoring functions that could help them

keep track of people they look after even when they were away. These monitoring functions included tracking the amount of medication taken, reminding when to take medications, and alerting caregivers if medication was not taken on time.

> *"My mum is diabetic and her medications keep changing every month and it makes it hard for her and me to keep track of her medicines."* (P3, informal caregiver).

While caregiver participants generally agreed that medication taking could be challenging for older adults, some thought that if medication intake monitoring could be combined with overall health monitoring, health improvements could motivate older adults to regularly take their medication. Additionally, seven caregivers noted that feelings of missing family members (e.g., children), could also contribute to medication non-adherence in older adults, and a robot could potentially help address this issue. As one participant stated:

> *"Having a recording of a family or friend talking and persuading the patient to take the medication is useful. Also having the robot to track the patient's improvements would be great"* (P15, formal caregiver)

However, older adult participants raised trust and privacy concerns as social robots usually have cameras to support their navigation in real settings. They worried about the potential of using social robots for surveillance-related actions, and that the robot could be recording them without their consent:

> *"It's like having a 24 hours CCTV cameras sort of thing."* (P23, older adult)

Despite these concerns, caregivers still suggested that robots could act as *"communicators"* between older adults and health professionals. Both formal and informal caregivers agreed that robots could also help older adults to better understand the medications' characteristics, their side effects, and their severity. They believed that this would help people better understand why and how they needed to take medications, which could make them more adherent.

> *"Communication between doctors and patients plays an important role. Some people do not understand why they have to take medications or which ones to take. Taking the wrong medication can cause more harm. Also, people need to understand their illness and how to treat it"* (P12, informal caregiver)

Moreover, caregiver participants thought that it could be useful if the social robot was monitoring unintentional non-adherence and tracked the reasons why

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their loved ones have missed medications. They also suggested that such robots could act as observers that could intervene when necessary:

> "[If] *the patient does not take their medicine for more than two days constantly, the robot should alert the hospital and family members*" (P9, informal caregiver)

4.2. Socio-Technical and Spatial Challenges

Participants identified challenges related to using social robots in home settings. For example, two informal caregivers raised issues regarding older adults' technology usage and were concerned that social robots would be treated like other smart devices, i.e., older adults would turn the robot off or simply ignore it.

> "*I bought Alexa for my parents. Part of the reason for buying it was that Alexa can remind them when it's their medication time but my dad keeps turning the device off because it's consuming too much electricity*" (P10, informal caregiver)

Both older adults and caregivers initially found it hard to imagine having a robot in their lives because they worried that new problems would be introduced. All participants, in one way or another, emphasised that every home is different and a social robot may not be suitable for all of them, *"Where will the robot stay, would it stay upstairs or downstairs?"* (P4, informal caregiver). Concerns were raised about the robot's mobility within the home, as it might be unable to freely navigate the space or locate the person requiring medication reminders. However, participants' perspectives shifted after watching the video of an older adult interacting with a robot, which allowed them to envision the potential benefits of having a robot in their own homes. An older adult participant mentioned

> "*I had an idea about a care home but because there are already many staff members there. So maybe if it is in someone's home, especially if they're living on their own. That would probably work best.*"(P22)

Furthermore, both caregiver and older adult participants expressed concerns about their level of technical proficiency required to operate social robots, as they lacked prior experience with such smart devices. Additionally, they questioned the rationale behind conducting research on social robots, considering the high cost associated with acquiring and maintaining these robots. For example, P26, an older adult mentioned *"surely this robot comes at a cost and not everyone will have a budget for this"*. Further, P8, an informal caregiver who previously bought a voice assistant for his mother, worried about using

more complex devices as she was *"a complete technophobe"* and would not want to use an expensive robot. Moreover, both caregiver and older adult participants also had concerns about robot's general maintenance at home, especially when a robot breaks down. For example, one participant stated:

> "*What if it stops working in the middle of the night, I can't fix it. I can't program it.*" (P19, older adult)

While the majority of caregiver participants acknowledged the benefits of using a social robot to assist older adults, 9 out of 18 caregivers also anticipated potential challenges related to the older adults' understanding of the robot. Concerns were raised about the quality of the robot's voice and its compatibility with the older adults' pre-existing disabilities. For example, one participant commented:

> "*Problem with my mum is that she wears two hearing aids and it might be difficult for her to understand what the robot is saying.*" (P8, informal caregiver)

4.3. Potential Impact on Independent Living

We observed differences in general attitudes towards robots between caregivers and older adults. Despite the concerns and challenges discussed above, all caregiver participants were positive about social robots. They thought social robots could help them in providing medications to the older adults and also help older adults in their daily activities to support their independent living. Furthermore, caregivers believed that social robots could provide companionship to older adults when they are feeling lonely and make them feel closer to their family. For example, an informal caregiver commented:

> "*Robots can be programmed in a way that they should address the emotional needs of the patient, so maybe if they are attached to their family or their close ones. So robots can motivate them by calling or showing pictures of their loved ones to deal with their loneliness and make them happy*" (P9)

However, unlike caregivers, older adult participants had mixed opinions about the robots. Only 2 (out of 10) were positive about robots in relation to independent living. These two participants thought that having a robot would mean they could be more independent and that they would not have to depend on others to help them with their medications.

> "*Isn't it cool to have my very own personal robot assistant? I won't have to rely on my children to come and give me medications*" (P21, older adult)

> "*When an older person is alone, they just need conversation, they kind of need company in their*

home so having a robot talking to them in this way is kind of a positive thing, but I think it might not be for everybody"(P26, older adult)

In contrast, the remaining 8 older adults were concerned about losing independence and control of their medications, and repeatedly mentioned their need for being able to make their own decisions. In their current situation, they did not perceive the need a robot.

"If I am taking medications the morning, noon and night, I just need my pill box and I can do it myself. I can't think of it any other way." (P24, older adult)

"I think I would prefer a real person to listen to." (P28, older adult)

They were also worried about over-reliance, accountability and risks the robots could introduce. They had concerns that having a robot at home could make users more vulnerable over time.

"Let's say a robot is helping an old lady. She is reliant on the robot for this walk and the robot stops working as she falls, whose fault is it? You know, there's a risk, a huge risk, associated with that going wrong so who then is culpable where is the accountability in that scenario?" (P25, older adult)

5. DISCUSSION

Our aim was to (i) understand how social robots could assist caregivers and older adults in their medication management practices, and (ii) explore robots' potential to support the caregivers and improve the quality of care provided to older adults at home. Our findings show that older adults may see robots in their homes as a hindrance, while caregivers see robots as a way to support them in their caregiving tasks. Overall, while participants saw the potential of using social robots at home, they also highlighted several practical (maintenance, cost) and emotional (trust, independence) challenges. Reflecting on these challenges, we extend previous research on using social robots to support older adults' (e.g. Emadi et al. 2022; Leung et al. 2022; McGlynn et al. 2017) by highlighting tensions that need to be taken into account when designing social robots that aim to support medication adherence in home settings. These tensions emphasize the complex nature of home medication management and conflicting needs of different users.

5.1. Tensions Between Benefits and Practicalities

The practical challenges and concerns of having social robots in home settings mentioned by our participants align with ethical issues (e.g., privacy) identified in previous studies conducted with older adults (e.g. Niemelä et al. 2021; Calisto et al. 2023). While robots may be considered as an alternative to support such needs in various contexts (Chen et al. 2020), they are still ill-equipped for domestic environments, which was reflected in P4's comment about a potential location for a robot in a multilevel house as it is difficult to find a place for monitoring devices at home (Grönvall and Verdezoto 2013). To be more feasible, robots need to be able to navigate in different types of home architectures, as well as be able to hide away or be invisible if people prefer not to keep them visible. This has a potential to support the independence of older adults, allowing them to perform tasks that would otherwise be difficult or impossible at home.

We also highlight several other challenges such as home maintenance and cost that conflict with the potential benefits of having social robots. Similar to other confined environments and medical restrictions (Carros et al. 2020; Krzykowska-Piotrowska et al. 2021), maintenance, infrastructure, and technical support need to be considered because not everyone can afford a robot or build a certain infrastructure required to have one at home. For instance, implementing a smart home infrastructure with various sensors and an autonomous robot to assist older adults in household chores and monitor their health and safety could greatly alleviate the burden on caregivers. However, the cost associated with such a system may be prohibitive for many households, and older adults may find it challenging to adapt to and afford such a high-tech solution, especially that the cost of installing and maintaining the system is high (Chung et al. 2016) and older adults may not want to spend money on this.

5.2. Tensions Between Trust and Independence

Alligned with Lavin et al. (Lavin et al. 2022), our study participants also highlighted the emotional challenges older adults could face when having social robots in their home settings. Previous studies show that older adults pointed out the feeling of loneliness when their family was not around Broekens et al. (2009). The presence of social robots in the home environment offers the potential to mitigate these feelings of loneliness by providing companionship and support. However, an inherent tension arises between the need for emotional connection and the desire for independence among older adults. While social robots can offer companionship Coghlan et al. (n.d.) and medication related assistance, some participants in the study expressed concerns about relying too heavily on these robots and the potential loss of human interaction and relationships.

Participants also highlighted trust issues related to monitoring and potential impact on independence, which aligns with previous research (e.g. Zafrani et al. 2023). Older adults in particular were less willing to be monitored and more critical compared to caregivers when talking about putting the robot in their homes to help with medications, which also echoes existing research (e.g. Broadbent et al. 2014; Zouba et al. 2009). Moreover, for a robot to be accepted and adopted by the users, it is essential that the users are able to fully understand the purpose of the robot (de Graaf et al. 2016). It is also important to consider who should be in control (the robot or the user) (Sheridan 2016) and who is the target user (a caregiver or an older adult). For instance, older adults may have varying levels of technological literacy or physical limitations that need to be accommodated (Coghlan et al. n.d.). The robot's interface should be intuitive and user-friendly SAM et al. (2023), ensuring that older adults can easily interact with it and understand its functionalities. On the other hand, if the target user is a caregiver, the robot should provide the necessary support and assistance to alleviate their workload and enhance their caregiving experience.

With the above in mind, there is potential to develop a robotic system where caregivers and older adult users can choose between a *human in-charge* mode or *robot in-charge* mode before the interaction, as suggested by Yu et al. (2015). Providing older adult and caregiver users with this level of control is essential for medication management in home settings, since they will be able to select and control the level of assistance they require and reduce the risk of robot errors, as our participants expressed concerns about using robots to help older adults because they can make errors. Furthermore, to ensure a robot can support existing routines and fits into older adults' lives, future research may consider to develop a virtual *Caregiver-Robot team*, similar to the system developed by Nanavati et al. (2023), where at one instance the caregiver cooked food and robot helped to feed that food to the patient. This can be applied in medication management scenario as well where robot can help caregivers to feed the medications to the patients. Thus, robots could open a potential space to collaborate between care tasks and detect when and how they should be used to reduce workload on caregivers. Given the privacy concerns our participants raised, the robot would also need to be transparent and inform users when they are being recorded and ideally provide options to switch off the camera recordings to ensure their independence preferences. Finally, embedding proactive warnings would also help users understand and manage the logistical issues such as charging and robot maintenance (Chang et al. 2020),

which could address the issues with limited technical knowledge and experience.

5.3. Limitations

The majority of our older adult participants were women, which may have influenced the overall perspectives obtained, especially that the two participants who were more positive regarding robots and thought they would improve their independence were men. Research by Schermerhorn et al. (2008) suggests that women tend to perceive robots as more machine-like, while men view them as more human-like, leading to variations in attitudes towards robots. However, despite this gender imbalance, our findings were consistent with existing research (e.g. Prakash et al. 2013) that showed that the practical challenges in home settings highlighted will be the same regardless of the gender. Additionally, we had an equal distribution of male and female participants among the caregiver group to provide a more balanced representation. Participants' opinions about robots were based on the slides and illustrative video. While these prompts might have influenced their opinions, we needed them to be able to support envisioning and discuss the potential role of robots with participants who never interacted with one directly. To reduce the potential bias, we ensured that the discussions focused on participants' everyday routines and how social robots would fit into their households, which provided insights on potential challenges.

6. CONCLUSIONS AND FUTURE WORK

Social robots offer an innovative opportunity to support medication management, but at the same time introduce new challenges. Our study highlighted several such opportunities e.g., using robotic help to provide information about medications and emotional support, or monitoring patients. However, practical issues related to keeping a robot at home need to be addressed, such as cost, maintenance, and privacy. Additionally, our paper discussed and compared the perspectives of older adults and caregivers on social robots, which sometimes align, but could also conflict. As a result, there were tensions between the potential benefits of a robot and the anticipated challenges it would introduce and its potential impact on older adult's independence. Overall, our work highlights the need for careful design implications that successfully integrate social robots in home settings and result in positive health outcomes for both older adults and caregivers.

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A. PARTICIPANT DETAILS

Participants ID	Gender	Caregiver type	Years of experience as a caregiver
P1	Male	Informal caregiver	2
P2	Male	Informal caregiver	10+
P3	Male	Informal caregiver	3+
P4	Male	Informal caregiver	3+
P5	Male	Informal caregiver	4
P6	Female	Informal caregiver	2+
P7	Male	Informal caregiver	5+
P8	Male	Informal caregiver	4
P9	Female	Informal caregiver	3
P10	Female	Formal caregiver	2
P11	Female	Formal caregiver	1
P12	Male	Informal caregiver	4+
P13	Female	Formal caregiver	8+
P14	Female	Formal caregiver	10+
P15	Female	Formal caregiver	6+
P16	Female	Formal caregiver	5+
P17	Male	Formal caregiver	5+
P18	Female	Formal caregiver	5+

Table 2: Participant details – caregivers

Participants ID	Gender	Years of taking medications
P19	Female	15+
P20	Female	20+
P21	Male	20+
P22	Female	2
P23	Female	4+
P24	Female	10+
P25	Female	5+
P26	Female	5+
P27	Female	15+
P28	Male	20+

Table 3: Participant details – older adults