Evaluation of the Use of a Touchscreen Assistive Device for People with Dementia: A Pilot Study

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Abstract

Background. People with dementia (PWD) have difficulty adhering to their medication regiment and maintaining a sense of identity and social connectedness. Moreover, caregivers constantly worry about PWD especially when they are left home alone. **Objective.** To examine the usefulness and usability of the Claris Companion (CC) in assisting PWD and their caregivers. **Results.** Most participants found some of the communication functions, leisure functions and reminder functions difficult to use. They found that the email/text messaging, photos and videos function useful. Surprisingly, they did not find the reminder functions useful. **Conclusion.** This study demonstrated how the CC could help PWD regain their sense of identity and feel more socially connected to their family and friends. Furthermore, it also demonstrated how the CC gives peace of mind to caregivers in leaving PWD home alone while they are at work or running errands.

Résumé

Contexte. Les personnes avec la démence (PAD) ont de la difficulté à adhérer à leur régiment de médicaments ainsi que maintenir leur sens d'identité et de sociabilité. De plus, leurs proche-aidants s'inquiètent constamment de la PAD, spécialement lorsque qu'ils ou qu'elles sont à la maison tout(e)s seul(e)s. **Objectif.** D'examiner l'utilité et l'utilisabilité du Claris Companion (CC) pour assisté la PAD et son proche-aidant. **Résultats.** La plupart des participants ont trouvé les fonctions de communication, loisirs et de rappels difficiles à utilisés**.** Ils ont trouvé la fonction de messages courriel/SMS, les photos et les vidéos utiles. Étonnamment, ils n'ont pas trouvé les fonctions de rappels utiles. **Conclusion.** Cette étude démontre comment le CC peut aider la PAD à reprendre leur sens d'identité et sociabilité. De plus, ça démontre aussi comment le CC donne aux aidants naturels un sens de tranquillité d'esprit lors qu'ils ou qu'elles sont au travail ou font des courses.

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1.0 Introduction

It is a well-known fact that the world's population is aging. In 1990, there were 330 million people 65 years of age or older, representing 6.2% of the world's population (United Nations, Department of Economic and Social Affairs, 2013). This number increased to 530 million people in 2010, representing 7.7% of the world population (United Nations, Department of Economic and Social Affairs, 2013) and the number is expected to increase to 967 million by 2030, representing about 11.8% of the world population (National Institute on Aging, National Institute of Health, U.S. Department of Health and Human Services, 2011). In Canada, the percentage of people 65 years of age or older is even larger. According to Statistics Canada (2014), in 2014, there were 5.58 million Canadians 65 years of age or older, representing 15.7% of the Canadian population. This percentage is expected to rise to approximately 22.5% by the year 2030.

Since the risk of dementia increases with age, it is expected that the number of people suffering from dementia worldwide will grow significantly over the next few decades (National Institute on Aging, National Institute of Health, U.S. Department of Health and Human Services, 2012). According to Wimo & Prince (2010), the number of people suffering from dementia worldwide was 35.6 million in 2010 and this number is expected to increase to 65.7 million by 2030.

The increase in the number of people suffering from dementia is expected to become a huge burden on healthcare resources. For instance, according to the Alzheimer

Society of Canada (2010), within the next thirty years, the demand for long-term care is projected to increase tenfold. Thus, it is crucial to understand the impact of dementia on persons with dementia (PWD) and their caregivers in order to find a more efficient way to allow them to live in their home.

A solution to this problem is the use of technology such as information communication technologies or ICT (e.g. touchscreen tablets). However, the problem with ICT in the market today is that they do not target PWD and their caregivers. Thus, they do not meet their needs and are difficult for them to use.

This thesis investigates whether people with mild to moderate dementia can use a touchscreen ICT device. It also examines the usefulness of such a tool for people with mild to moderate dementia.

2.0 Literature Review

2.1 Impact of Dementia on Caregivers and PWD

In light of these statistics, it has become increasingly important to understand the daily difficulties experienced by PWD and their caregivers. Dementia gradually impairs the ability of PWD to manage different aspects of their daily lives (Giebel, Sutcliffe, & Challis, 2015). As a result, caregivers have to help PWD overcome these impairments, which subsequently increases their own burden (Kim, Chang, Rose, & Kim, 2012).

2.1.1 Impact of dementia on PWD. PWD can experience different functional deficits according to the stage of dementia they are experiencing (Marsico et al., 2014). People with mild dementia typically experience problems with recent memories (e.g. might ask the same question repeatedly), may have difficulty controlling emotions (e.g. seen as more irritable and short-tempered) and begin having difficulties with complex tasks (e.g. handling medication, driving, managing finances). People with moderate dementia typically can no longer do complex tasks without help (e.g. preparing meals, handling housework), they may also exhibit some impaired judgement in many aspects of life (e.g. personal safety) and they may start withdrawing from family and friends because socialization becomes difficult. People with severe dementia increasingly need help with personal care (e.g. bathing, shaving), may become incontinent, may have difficulty speaking in full sentences, may not remember close family and friends and may start showing evidence of compulsions (repeating simple behavior) and delusions (believing something that is not true).

When PWD were asked about the biggest impact of dementia in their lives, PWD

cited inability to manage their own medication regiment, loss of sense of identity and decline in feeling of social connectedness (Miyamoto, Tachimori, & Ito, 2010; Campbell, et al., 2012; Genoe, 2010; Moyle, Kellett, Ballantyne, & Gracia, 2011).

According to Campbell et al. (2012), as dementia progresses, PWD are less able to comply with their medication regiment. In many cases, their medication regiment becomes increasingly complex as a result of the multiple health conditions (Gillespie, Mullan, & Harrisson, 2013; Kaasalainen et al., 2011) and their resistance in getting help from their caregivers (Erlen et al., 2013). In the early stages, PWD are in denial of having dementia whereas in the later stages, the behavioral symptoms of dementia impede their compliance. One hypothesis is that in the early stages, PWD resist getting help because they do not feel that they are impaired. Thus, they often have difficulty understanding why caregivers are trying to take over their medication management. On the other hand, in the later stages, PWD often refuse to take their medications due to delusional, suspicious or paranoid thinking. In some circumstances, PWD may think that their caregiver has motives for controlling their medication that are not in their best interests.

The strategy most commonly used by PWD to overcome the challenge of adherence to their medication regimen is to incorporate medication administration as part of their daily routine such as synchronizing it with meals (Gillespie et al 2013). Other strategies include the use of blister packs or dosettes to verify whether a medication was taken (Kaasalainen et al., 2011). Furthermore, external memory triggers such as Post-it notes are used as reminders (While, Duane, Beanland & Kotch, 2012). When these strategies were used, PWD were better able to adhere to their medication regiment. Many

technologies have also been introduced to help PWD manage their medication regiment (refer to section 2.2.3.1).

The second challenge that will be addressed is related to the PWD's sense of identity. According to Genoe (2010), the stereotypes enforced by society have a negative impact on the sense of identity of PWD. While aging alone can be associated with stigma and negative stereotypes, when an older adult is diagnosed with dementia, he or she is faced with the double stigma of being older and having memory problems. As a result, he or she may experience the loss of valued roles that are an important part of their identity (Genoe & Dupuis, 2012). These negative assumptions about the abilities of PWD can be internalized, resulting in identity loss which becomes cyclical. As fewer roles are available, one is at greater risk for neurological degeneration, which in turn decreases the capacity to sustain roles that remain (Genoe, 2010).

Genoe and Dupuis (2012) found that PWD were proud of their ability to cope with dementia and incorporated this ability into their identity. PWD found ways to sustain the aspects of their identity that they valued the most. They acted out roles that were particularly meaningful to their identity in the same way they always did. When this was not possible, PWD found ways to experience the same role differently while garnering the same benefits. For instance, one of the participants in their study had a very competitive nature and thus enjoyed playing competitive sports such as sailing. After his dementia diagnosis, he started playing golf and just competing with himself. Furthermore, Genoe (2010) found that participation in leisure activity could help PWD break the cycle of identity loss. That is, leisure activities provide PWD with new roles to

replace those that are lost, decreasing neural degeneration, and maintaining the capacity to perform remaining roles.

The third challenge is related to the feeling of social connectedness experienced by the PWD. As dementia progresses, PWD are less able to socially connect with people around them which leads PWD to experience feelings of loneliness and social isolation (Alzheimer Society of England, 2013; Moyle et al, 2011; Rousseaux et al, 2010). There are many factors that can help explain why PWD feel those negative emotions. The first reason is that loneliness could be considered a consequence of the deteriorating social skills that are part of the changes experienced by PWD (Rousseaux, Seve, Vallet, Pasquier, & Mackowiack-Cordoliani, 2010). Age-related factors such as problems with mobility, speech and hearing can further impede their ability to socially interact with others (Moyle et al, 2011). This exacerbates their feeling of loneliness and social isolation. The second reason is that although PWD receive many visitors, they may not remember that somebody has visited them. Thus, they do not perceive the social contact and feel lonelier (Alzheimer Society of England, 2013). The third reason is that sometimes PWD may live far away from family members and friends (Moyle et al., 2011). As a result, they may not have the opportunity to visit PWD on a regular basis thus contributing to PWD's feeling of loneliness and social isolation.

Gonzalez, Mayordomo, Torres, Sales, and Meléndez (2015) found that reminiscence therapy could help improve the feeling of social connectedness in PWD. Reminiscence therapy is the use of various forms of stimuli such as music, photographs, and newspapers to help trigger memories of important life events (Cotelli, Manenti, Zanetti, 2012). According to Astell et al. (2010), the stimuli used in reminiscence therapy

provide a target of joint attention. Joint attention occurs when one individual directs the attention of another individual to an object. For instance, a PWD may have pictures of various meaningful life events throughout their home. If someone visits the PWD and sees a picture of interest, they might point their finger towards it. The PWD might then turn their own attention towards the picture, which may trigger a conversation.

2.1.2 Impact of dementia on caregivers. As a result of the increased responsibilities and impact associated with dementia, the people that are left to carry the bulk of the care for PWD are often family members, more specifically their spouses and adult children (Kim et al, 2012). At diagnosis, the stigma associated with dementia often makes the initial news quite difficult for caregivers (Aminzadeh, Byszewski, Molnar, & Eisner, 2007). As the disease progresses, caregivers need to increasingly take over different aspects of the lives of PWD despite the limited health resources available to them (Kim et al, 2012). This often leads to adverse physical and psychological effects. The adverse physical effects include increased stress hormones, blood sugar levels and blood pressure. These physical effects can increase the risk for cardiovascular disease, stroke and diabetes (Burke et al., 2015; Richardson, Lee, Berg-Weger, Grossberg, 2013). The most common adverse psychological effect is depression, which is often accompanied by guilt and frustration (Burke et al., 2015; Richardson et al, 2013).

Caregivers often have to handle multiple roles in their family lives, with a set of demands associated with each role (Sun, 2014). The added role of caregiver often comes at the cost of other roles such as parenting their own children (Lee & Smith, 2012). This role overload may create friction within the family as some family members start resenting the attention given to PWD while they feel neglected (Yang, Liu, & Shyu,

2014). In order to optimize their quality of life, caregivers must learn to find a balance amongst all these roles.

Caregivers also need to learn to balance their career demands with their caregiving demands (Wang, Shyu, Tsai, Yang, & Yao, 2012). On the one hand, their career provides them with an opportunity for normal social exchanges with friends and peers, which is a type of interaction that is often lacking in their caregiving role (Li, Shaffer, & Bagger, 2015). On the other hand, caregiving responsibilities may negatively affect their productivity, which could lead to lost opportunities for a salary raise and a promotion (Honda, Date, Abe, Aoyagi, & Honda, 2014; Li, Shaffer, & Bagger, 2015). Moreover, they may need to take more time off work than other employees or may need to give up employment entirely to meet care demands (Honda et al., 2014; Li et al., 2015). This role conflict will affect not only caregivers but also society as a whole. According to the Alzheimer Society of Canada (2010), Alzheimer's disease is expected to cost society over 15 billion dollars as informal caregivers take time off work in order to take care of PWD.

Caregivers need to find strategies to balance their caregiving role with the other roles they have in their lives. One strategy that is often recommended is to use respite care. Respite care is any intervention designed to give rest or relief to caregivers while the PWD is under the care of another temporary caregiver (Stern, Blanchard, & Bourgeois, 2014). However, respite care is part of the increasingly limited healthcare resources available to PWD and their caregivers. Phillipson, Magee, & Jones (2013) administered a survey to caregivers of PWD living in the community to explore their views on out-of-home respite care and why some caregivers do not use them. According

to this study, caregivers were concerned that out-of-home respite care may not benefit PWD and may even have a negative impact on them. One alternative strategy could be for PWD to take a more active role in their own care. This, in turn, would help decrease the load on the caregiver (Martin, Turner, Wallace, & Bradbury, 2012; Mokhtari et al., 2012) allowing them to have more energy to contribute to their other roles.

Self-management involves a strategy "where the individual with a long-term condition is encouraged to learn to manage their health and identify solutions to meet their specific needs" (Mountain & Craig, 2012, p.576). Mountain and Craig (2012) suggested that a self-management intervention targeting PWD should have seven components:

(i) Rethinking of dementia in a more positive and realistic way.

(ii) Living with dementia by making the most out of routines and strategies to manage memory loss.

(iii) Building and maintaining relationships with friends, and rediscovering relationships with spouses and children.

(iv) Experiencing wellbeing through engagement in volunteering, hobbies and leisure activities.

(v) Using everyday technology to ensure safety at the home and in the community.

(vi) Keeping physically well by engaging in physical exercise and ensuring proper medication management.

(vii) Building and developing skills by using problem solving strategies.

Toms, Quinn, Anderson and Clare (2015) identified the facilitators and barriers to self-management of dementia based on interviews with PWD. Adopting routines was found to be one of the most important facilitators by PWD. In order to ensure that the routines are followed, PWD discussed the importance of the presence of triggers to help them remember a specific task such as washing their teeth. PWD also discussed the importance of asserting their retained abilities. Thus, according to this study, PWD would benefit from focusing on the abilities they still have as opposed to the abilities they have lost. However, this may be hard to put into practice since PWD may acknowledge that they do not function like they did previously, resulting in a decline in self-confidence and impeding their ability to self-manage. PWD can also have age-related comorbidities that can further impede their ability to self-manage.

Everyday technology can facilitate this process and make it more efficient.

2.2 Technologies for PWD

The significant advances in technology that have taken place during the past few years have enabled the design of many novel devices that might facilitate self-management of dementia. The reduction in weight and cost of these devices and their inclusion of communications, computing, display alternatives and sensing abilities have led to the introduction of new products that were not available in the past. Examples of these products include smartphones, laptops, tablets, smart appliances, assistive devices, medical equipment and wearable monitors. Most of these devices use information and communications technology, otherwise referred to as ICT.

ICT devices usually incorporate three main functions: communication (e.g. WiFi, Bluetooth, 3G), computing functions (e.g. email, browsing, video download) and user interface (e.g. microphone, loudspeaker and touchscreen display). Most of the ICT devices also include other sensors such as an accelerometer, a gyroscope or a global positioning system (GPS). These components make possible the use of software, which, without it, the ICT device would be useless. There are two types of software applications: general-purpose and special purpose. General-purpose software applications include browsing the web (e.g. Safari), handling emails (e.g. Gmail), communicating with others (e.g. audio/video calling) and document management (e.g. MS-Office). Special-purpose applications include health monitoring and educational tools that may involve some communications, computing and sensing. General-purpose applications allow the user of a tablet to select which application to run. However, some of the special-purpose applications are configured in a way that allows them to run automatically when the ICT device is turned on. They generally do not allow the user to select any other application, thus making it a special-purpose device.

The role of technology in dementia care is still in its infancy (Sugihara, Fujinami, Phaal, & Ikawa, 2013). There are still very few assessment studies focused on supporting the independent living of PWD through the use of technology (Mokhtari et al., 2012). ICT devices with specialized software applications are now being used as assistive devices to help people with chronic diseases and disabilities increase, maintain, or improve their functional abilities (Fuhrer, Jutai, Scherer, & DeRuyter, 2003; Jutai, Fuhrer, Demers, Scherer, & DeRuyter, 2005; Scherer, Jutai, Fuhrer, Demers, & Deruyter,

2007). These specialized software applications have to take into account the needs and limitations of the end-user and have to be designed to accommodate them.

Our understanding of whether people with dementia and their families can use these devices is an area of increasing interest.

2.2.1 Acceptance of assistive ICT by PWD. There are many different stakeholders that are involved in the development of an assistive ICT device (Brankaert, Ouden, & Brombacher, 2015). First, healthcare professionals consult with the intended users to assess their needs and determine the specifications of the assistive ICT device. Once these specifications are finalized, engineers and computer scientists design the hardware, software and the necessary user interface. During this process, it is important to ensure that the assistive ICT device does not interfere with other devices and does not harm the users in any way. The next phase is to test the device with all stakeholders to ensure that it meets their needs in terms of functionality and user interface. What matters in the end is whether or not the users are satisfied with the product. Thus, it is important to make sure that they are involved in all phases of the design, implementation and testing to ensure that their needs are met (Span, Hettinga, Vernooij-Dassen, Eefsting, & Smits, 2013). While this section will discuss some of the factors that affect the acceptance of assistive ICT by PWD, touchscreen ICTs will be discussed in section 2.2.4.

The baby boomers, that form the majority of the current senior demographic worldwide, were raised prior to the mass usage of ICTs and may take longer to adopt new technologies (LeRouge, Van Slyke, Seale, & Wright, 2014). It takes even longer for PWD because dementia exacerbates their ability to deal with change, and will affect

skills necessary for ICT usage (Rosenburg & Nygard, 2013; Rosenburg & Nygard, 2011). Rosenburg and Nygard (2013) conducted individual interviews and focus groups to explore how PWD and caregivers approach using ICT such as electronic memory aids and cell phones. The study's findings suggest that if an assistive ICT device was given to a PWD that required them to change their daily routines, the PWD tended to continue with their normal routines and did not appreciate the device. Moreover, the PWD did not perform a given task using the assistive ICT device unless it allowed them to somehow enhance their performance. For example, in cases where a PWD might occasionally miss taking their medication due to distractions, they appreciate an assistive ICT device that reminds them to take their medication on time.

However, in order to use an assistive ICT device correctly, users have to learn not only how to use the device but also how to retain this knowledge. Since most PWD were not raised with ICT, even the basic functions of the tool must be learned. Their cognitive impairment may will also impede their ability to retain and process this information. Yet, according to Rosenburg & Nygard (2013), PWD are able to learn how to use assistive electronic memory aids and cell phones and retain these skills through its continued use for a prolonged period of time. This discrepancy happens because authors rarely describe the level of functional limitations experienced by the PWD.

In order to ensure PWD's continued usage of an assistive ICT device, there should be many different triggers available to remind PWD to use it (Rosenburg & Nygard, 2011). For example, some PWD used assistive ICT devices only when certain environmental cues were present. Thus, caregivers needed to position the device close to

the environmental cue. For instance, when the dosette was right beside the assistive ICT device, the PWD was more consistent in taking their medication.

Assistive ICT devices need to be effectively incorporated into PWD's daily routine. They need to have a user-friendly interface designed specifically for PWD. Assistive ICT devices should also be able to accommodate other age-related impairments such as problems with vision, dexterity and hearing (Boman, Rosenberg, Lundberg, & Nygård, 2012). Assistive ICT devices that meet these criteria will be discussed in sections 2.2.4.1 and 2.2.4.2.

2.2.2 Acceptance of assistive ICT by caregivers. Caregivers are important stakeholders when it comes to assistive ICT devices for PWD (Alwin, Persson, & Krevers, 2013; Rosenburg, 2009). As described in section 2.2.1, enabling PWD to self-manage their own care can reduce the burden on caregivers. ICT devices can provide a means to achieve this goal as well as alert caregivers of any problems, thus giving them peace of mind.

In order for an assistive ICT device to be effective for the self-management of PWD, it is important to understand what the caregiver and PWD expect from the assistive ICT device and ensure their expectations are met. Rosenburg, Kottorp, Nygard (2012) conducted individual interviews and focus group discussions with caregivers to explore this issue. Caregivers were ready to try new assistive ICT devices when they perceived them as beneficial to their caregiving role and it would meet their needs. Caregivers suggested that new functions be introduced gradually to PWD so they could have the opportunity to learn and assimilate a function before a new one is introduced. It was

emphasized that for a new technology to be accepted, it should be familiar to the PWD. For example, it could be similar to another technology that the PWD understands well and has used in the past (e.g. radio). Moreover, some of the participants thought that it was important that the technology be equipped with intelligent functions that prevent the user from making mistakes. Participants stated that it was also important that the device does not look stigmatizing and that the user has the ability to personalize the technology to meet their needs.

Although assistive ICT devices have the potential to considerably alleviate the load on the caregiving role, it is clear that it will not completely remove it (Godwin, Mills, Anderson, & Kunik, 2013). Caregivers will still have to monitor whether PWD are properly self-managing their own care. This creates ethical concerns as PWD may feel that this constant monitoring by their caregivers violates their integrity. While debatable, Olsson, Engstrom, Skovdahl and Lampic (2012), are of the opinion that the opportunity to use ICT devices to create a safe and secure environment for both the PWD and their caregiver overshadows the potential ethical problems of violating the integrity of the PWD. Depending on the tool, assistive ICT devices can reduce caregivers' constant fear and concerns that something could happen to the PWD yet still allow PWD to maintain their independence.

Thus, ideally, ICT devices should be properly customized to meet the needs of PWD and designed to give their caregivers peace of mind. Assistive ICT devices that can contribute to the self-management of PWD will be discussed in sections 1.4.3 and 1.4.4.

2.2.3 Available assistive ICT devices for PWD. There are many different types of assistive ICT devices that are currently available on the market. Some of these assistive ICT devices are very simple and use minimal technology while others are quite sophisticated. This section will focus on the types of assistive ICT devices that meet the needs of PWD described in section 2.2.1. In order to focus on the important areas that are impacted by dementia, the first part of this section will discuss assistive ICT devices that help with medication management, the second will address assistive ICT devices that help with leisure activities, and the third part of this section will address assistive devices that help facilitate communication between PWD and others. Section 2.2.4 will focus specifically on touchscreen assistive ICTs.

2.2.3.1 Assistive ICT devices for medication management. A simple approach to ensure that PWD adhere to their medication regiment relies on phone reminders. For example, the Trent Dementia Services Development Center (2006a) offers a fee for service medication reminder for PWD. The reminders can be fully personalized, so that, for example, the calls can come from a familiar voice. If the PWD does not answer, the caregivers are alerted. Other services complement the phone call with texts or emails (Artrix, 2000-2015). Other simple approaches rely on pill dispensers that are equipped with timers that could be programmed to remind the PWD to take their medications. For example, the Tabtime 4 is a daily medication alarm that has five tablet compartments each with their own pre-programmable reminder system (Trent Dementia Services Development Center, 2006b).

Other more sophisticated assistive ICT devices rely on dispensers that are able to detect whether the PWD has dispensed the medication on time (e.g.PivoTell's Advance

GSM). If a medication is not dispensed on time, text messages are sent to up to three family members or caregivers. Warning messages are also sent to alert caregivers of the status of the device. Alerts include the need to refill the medications, low battery and device error. The PivoTell device (Trent Dementia Services Development Center, 2006c) was used in a study on medication adherence in elderly patients with mild dementia (Kamimura, Ishiwata, & Inoue, 2012). The three-month before and after study was conducted to determine the efficacy of the PivoTell device used by eighteen participants and showed improvement in medication adherence. Other more complex devices such as the MedSmart MD2 Plus have a small display panel that shows more details about the medication supply in the dispenser (E-Pill, 1997-2015).

2.2.3.2 Assistive ICT devices for leisure. In general, a leisure activity is one that brings pleasure to the individual and that is usually not related to work, school, household chores and errands (Suchet & Stebbins, 2015). In the context of this thesis, leisure activities refer to the ones that can be provided by the assistive ICT device. These leisure activities include viewing pictures and videos as well as exercising and browsing the web. There are a large number of devices that provide these features such as laptops, tablets and smart phones. However, these devices are generally not adapted to PWD and are not always user friendly (Koumninos, Nicol, Dunlop, 2014). Many programs and applications tailored for PWD were introduced in recent years, however, the usability of these tools with this population has yet to be shown (Boman et al., 2012).

Simpler devices such as voice recordable photo albums or digital photo albums are commonly used as leisure devices for PWD. An example is the QED Talking Photo Album (Trent Dementia Services Development Center, 2006d). Pictures can be inserted

into the transparent sleeve with a ten second message recorded for each picture. As PWD look through the album, they can squeeze the play button to activate the speech.

More complex devices such as the Companion can provide audio-visual programs that can be personalized according to the life stories of the PWD. Kerssens et al. (2015) demonstrated that the audio-visual programs displayed on the Companion could help decrease some of the neuropsychiatric symptoms associated with dementia.

***2.2.3.3 Assistive ICT devices for communication*.** Simple devices, such as the Geemark Photophone100, are phones equipped with large buttons. They also include large speed-dial buttons where photos of frequently called individuals could be inserted (Alzheimer & Dementia Products Ltd., 2015). This feature allows PWD to contact their loved-ones with the simple touch of a button. This phone has amplified speakers and has a light that pulsates when the phone is ringing.

More sophisticated devices, such as CIRCA, rely on a touchscreen and several types of multimedia stimuli such as sounds and photos. The multimedia can help stimulate the minds of PWD. Astell et al. (2010) demonstrated that the CIRCA can help facilitate communication between the PWD and their caregivers (see section 2.2.4.1. for a more detailed description of this study).

2.2.4 Touchscreen tablets for PWD. Touchscreens are now incorporated in many assistive ICT devices, which significantly simplifies their interface. Furthermore, touchscreens have enabled the introduction of low cost tablets with a wide range of software that can be used in a variety of different contexts. A single tablet can run several programs and can therefore perform several functions, thus reducing the need to have

multiple devices. For example, touchscreen tablets can be equipped with both an email program and a calendar program. Thus it has communication functions and reminder functions.

Given the appropriate software, touchscreen tablets are one of the most promising technologies that could satisfy the needs of PWD and their caregivers for many reasons (Culén & Bratteteig, 2013; Håkansson, 2014). First, the interface of the touchscreen tablet is easier to use than a computer mouse. Second, there are fewer steps involved with completing tasks in touchscreen tablets than with a standard computer.

The following section will discuss two important issues associated with the use of touchscreen tablets by PWD. The first part will discuss the feasibility of the use of touchscreen tablets with PWD. The second part of this section will how the principles of universal design can be applied to further improve touchscreen ICTs to ensure they meet the needs of PWD.

2.2.4.1 Feasibility of the use of touchscreen tablets by PWD. As mentioned in section 2.2.1, ICT needs to be incorporated into the daily routines to ensure its adoption and continued use by PWD. Upton et al. (2011) evaluated the feasibility of incorporating touchscreen technology in nursing home settings. In this study, the iPad was used to look through pictures and listen to music. The authors conducted interviews with ten PWD and their care staff to look at the pros and cons of using iPads, the functions used in the iPads and how they could be improved. The authors also conducted focus groups with care staff and managers to determine whether iPads could be incorporated into the daily activities taking place in the nursing home. Some PWD used the iPad one-on-one with their care

staff while others used it as part of a group activity. The PWD in the one-on-one group had the opportunity to interact with the iPad directly. The PWD who participated in the group activities were only able to interact with the iPad indirectly through the facilitator. PWD and their nursing staff found that in both group sessions and one-on-one sessions the iPad facilitated interpersonal interactions. In the case of one-on-one sessions, the care staff found that iPads enhanced their relationship with the PWD. PWD also found that they were better able to relate with younger people through the use of iPads. Moreover, PWD in the group setting found that the iPad seemed easy to use as the nurse staff was using it for the group activity. Conversely, the PWD in the one-on-one setting found that the iPad was hard to use yet, easier to use than a computer. Some of the barriers encountered included weight and screen resolution. In this study, the iPad was just used to look through pictures and listen to music. The participants in this study were all living in nursing homes as opposed to the community and their degree of cognitive impairment was not specified.

Lim, Wallace, Luszcz, and Reynolds (2013) also demonstrated that there is potential for people with early-stage dementia to use an iPad. In their study, participants' cognitive status was assessed using Reisberg's 7-stage dementia scale. They were only eligible for the study if they were classified between stages 2 and 5. This means that they had very mild cognitive decline to moderately-severe cognitive deficits. As part of the study, 21 PWD and their caregivers were loaned iPads with preloaded leisure-type applications (i.e. art, music, games, and relaxation applications). Throughout the seven-day period, caregivers were asked to observe the PWD and determine whether they were able to use it independently. The caregivers were also asked to assess the level of

engagement of the PWD with the applications. The study found that about half of the people with dementia were able to use the iPad independently. The preloaded applications used in this study were only of leisure-type and did not include any reminder or communications features. It addressed the ease with which participants used the device but not whether it fulfilled any pre-identified needs. Another limitation of the study is the limited amount of time the participants spent had to use the tool and become accustomed to it.

In a study by Coppola, Yamagata, Kowtko and Joyce (2013), computer science students developed a software application for a touchscreen tablet to help PWD manage their neuropsychiatric symptoms (NPS) and stimulate their minds by playing interactive games. The students tested their games with PWD in nursing homes to assess their effectiveness. There were many challenges reported with regards to the use of touchscreen tablets by PWD. These challenges were further complicated by apraxia. Apraxia is one of the symptoms associated with dementia which affects PWD's ability to translate a verbal command to its corresponding motor expression (Chandra, Issac, & Abbas, 2015). The first challenge experienced by PWD was related to the operation of the touchscreen. The response of the tablet was inconsistent in terms of touch location accuracy and touch sensitivity. The second challenge experienced by PWD was related to the fact that the application icons were too close to each other. The combination of these two challenges resulted in many errors. The third challenge was that sounds generated by the applications and the feedback from the device was often confusing for PWD. The fourth challenge was that the device was too heavy and the screen size should not be less than 10.2 inches. A fifth challenge was that PWD experienced a lot of glare from the

screen. Many of the PWD recommended that the tablet have a popup stand. PWD initially had difficulty in becoming familiar with using touchscreen tablets. PWD had to be taught or reminded frequently how to touch the screen correctly with their fingertip as opposed to their fingernails. PWD also had the habit of dragging their fingers across the screen as opposed to tapping it. The results of this study added a considerable amount of information as to what features might need to be present for users with dementia. Two shortcomings of this study is that the authors did not specify the number of participants nor the degree of their cognitive impairment.

Donnelly et al. (2010) looked into the feasibility of incorporating video reminders into the mobile phones of PWD. The participants consisted of three young controls, two elderly couples, and four dyads of PWD and their caregivers. In the context of this study, The young controls did not have caregivers whereas the elderly couples did. The cognitive status of the PWD was assessed using the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975). Participants' score ranged between 22-28 or mild to moderate cognitive decline. The authors requested that caregivers record video reminders that could be uploaded into a database and transmitted to their dementia-affected loved-one's mobile phone at a desired time. The device generated an alarm whenever a new reminder is ready to be presented to the user. To start playback of the video reminder, the user is prompted to press the only button available on the device that also serves as an acknowledgement of the reminder notification. This in turn is relayed back to the database and can be accessed by caregivers via internet-enabled interface. The goal of this study was to obtain their feedback regarding the physical appearance, functionality/usability, future recommendations and general outcomes of the device.

Training was provided to each participant that then took the device home with him or her. Post-trial interviews were given to each participant to obtain their feedback. The feedback they received regarding the physical appearance is that the screen is too small and the device is too bulky. Users also mentioned that the use of a single button greatly facilitated its usability. Further feedback revealed that the audio/video quality was good but the reminder sound was unpleasant. The study did not explore whether or not PWD actually found those video reminders useful or not.

Astell et al. (2010) looked into the feasibility of using a touchscreen device that uses hypermedia to prompt reminiscing to help facilitate conversations with PWD. The participants included eleven PWD with mild to moderate dementia as well as the professional care staff with whom they were paired. Hypermedia refers to the concept of digitally linking various different forms of media together such as text, music, video and pictures. Astell et al. (2010) also had a control condition with traditional reminiscing sessions where professional care staff used some tangible stimuli such as pictures, newspapers and books to maintain conversation with PWD. They found that caregivers were able to provide more stimuli using the device and that they were much more likely to encourage the PWD to decide what they wanted to look at and talk about. This in turn gave the caregivers the chance to create more opportunities for the PWD to participate in the conversations and have a more equal role in the dialogue. This study showed that PWD are able to use touchscreen devices, which allowed them to be much more engaged in the conversation. Consequently, more features could potentially be added to further engage PWD. However, one of the shortcomings of this study is that although the

cognitive status of participants varied significantly, there was no comparison of their ability to use the tool.

Meiland et al. (2012) looked into the feasibility of using a touchscreen ICT, the COGKNOW day navigator (CDN) to support the independent living of individual with mild-moderate dementia. The study involved three successive one-year cycles. In the first cycle, they conducted workshops and interviews to get a sense of the needs and wishes of the dyad and included four dyads. In the second cycle, seven dyads were left with a prototype of the touchscreen ICT in their home. In the last cycle six dyads were interviewed to evaluate the user-friendliness and usefulness of the ICT. The prototype consisted of a stationary device and a mobile device. The functions on the ICTs were reminders, social contacts, and daily activities (radio and music). The mobile phone additionally had navigation support functions. The dyads liked the design of the stationary device: the size and sensitivity of the touchscreen were appropriate, as well as the button size and the number of buttons on the screen. The evaluation of the mobile device however was not as positive. The PWD found it too bulky and the battery life too short. The authors concluded that PWD and their caregivers are willing to accept ICTs like the COGKNOW day navigator (CDN), provided that they can rely on the technical performance and stability of the device. Most of the functions were well understood after one training session and easily used afterwards, although guided by caregivers. In this study, the caregivers did not receive any real-time feedback on the activities the PWD performed on the device.

Kerssens et al. (2015) explored the feasibility of using a touchscreen device (the Companion) to assist seven caregivers in managing some of the neuropsychiatric

symptoms of dementia (NPS). As with many other studies, the participants' MMSE scores ranged from 11-27, or normal cognition to moderate dementia. The Companion is a touchscreen computer that was developed to deliver psychosocial interventions to PWD in his or her own home. It uses rich audio-visual programs that combine images, music and messages from loved-ones that are relevant and pleasing to the PWD and thus engages him/her meaningfully and positively. These psychosocial interventions aim to address NPS that are barriers to independence. The Companion cues and primes for important activities and routines through explicit and timed reminders followed by images that are congruent with more desirable behaviour. Preferred music accompanies the programs unless requested otherwise. Seven community-living dyads were asked to identify factors related to the usefulness of the tools as well as the facilitators and barriers to the use of the Companion. The method used was structured interviews, observations, and assessments. Participants used the Companion for at least three weeks.

During an initial home visit, a baseline profile was obtained consisting of the PWD's cognitive state, functioning in activities of daily living, presence of neuropsychiatric symptoms, as well as caregiver strain and burden. The aim of the second home visit with the caregiver and the PWD provided a life story which subsequently served to personalize the device. During this visit they also conducted a separate one-on-one needs assessment interview with caregivers to know which NPS were the most distressing. The Companion was then placed in the home of the dyad for three weeks. Post-interview was based on the technology acceptance model and aimed to explore the usefulness and usability of the Companion. The results indicated that PWD were very interested in the possibilities of using technology and could be tested using it for short or

extended periods of time. They also suggested that physical limitations did affect independent technology use, which underscores the need to adapt technology to common user impairments. A majority of the PWD participating, (regardless of the severity of their cognitive impairment) indicated that they enjoyed the Companion programs and that they used the device as a pastime that brought back good memories and helped them relax and enjoy life. The Companion did not have any communication functions such as messaging and video/audio calling functions. Furthermore, the trial period was only three weeks, which might have been too short to measure any real effect.

2.2.4.2 Criteria for touchscreen tablets for PWD. As the previous section demonstrated, people with mild to moderate dementia can use current touchscreen ICT devices independently. However, to ensure widespread use of touchscreen ICT devices by PWD, there are some adaptations that must be done to cater to this population (Komninos et al., 2014). It has been recommended that the principles of universal design be used for achieving this goal (Boman et al., 2012). According to the principles of universal design, the design of ICT devices should be usable by everyone regardless of their age, abilities or status in life (Joines, 2009).

The first principle is equitable use; in other words, not stigmatizing. Thus, touchscreen ICTs for PWD should be aesthetic and appealing to all users and not draw attention or look like medical equipment or assistive technology (De Marco & Venneri, 2015). It is important for the design of the technology to be age-relevant so it does not cause embarrassment to the PWD, emphasizing their physical and cognitive impairments or making them appear different in any way (Rosenburg , Kottorp, & Nygard, 2012).

The second principle is flexibility in use. Thus, the design should respond to different functional limitations (Joines, 2009). The design should be flexible. For example, it should be possible to tailor the functions of the touchscreen ICT to meet the needs and skills of PWD (Rosenburg et al., 2012). The caregiver should be able to easily pre-program the touchscreen ICT with choices that are not visible to PWD (Kerssens et al., 2015).

The third principle is simple and intuitive use (Joines, 2009). Thus, the device should be easy for PWD to learn regardless of their previous experience or knowledge about touchscreen ICTs (Rosenburg et al., 2012).

The fourth principle is perceptible information (Joines, 2009). Thus, information on the screen should be easy to read (Coppola et al., 2013). Moreover, the screen should contain as little information as possible because of the user's limited ability to process and understand information (Rosenburg et al., 2012).

The fifth principle is tolerance for error (Joines, 2009). Thus, the design should minimize hazards and the adverse consequences of accidental unintended actions (Coppola et al., 2013; Rosenburg et al., 2012).

The sixth principle is low physical effort (Joines, 2009). Thus, touchscreen ICT should be comfortable to use, cause minimum fatigue and be easy to handle for PWD with decreased physical strength and inferior motor skills (Coppola, Yamagata, Kowtko and Joyce, 2013; Komninos, Nocol, Dunlop, 2014).

The seventh principle is size and space for approach and use. Thus, the device should accommodate for variations in hand and grip size. Screen text should have large font and there should be contrast between the text and background. It should be possible to adjust the volume and tone of the touchscreen ICT and these should be easy to change later on to meet users' individual needs (Coppola et al., 2013; Donnelly et al., 2010).

The adherence to these seven simple principles will ensure that assistive ICT devices are adequately suited to meet the needs of people with functional limitations such as PWD. The assistive ICT device chosen for this study adheres to these seven principles (see section 3.2.).

3.0 Rationale

3.1 Choice of Touchscreen ICT Device: Claris Companion

This study sought to identify an assistive device that provides reminders, communications and leisure functions while adhering to all the aforementioned principles of universal design. The Claris Companion (refer to Appendix A), a device manufactured by a Canadian company based in Vancouver, British Columbia (Claris Companion, 2014), was selected for this study. The Claris Companion is a touchscreen tablet that was specifically designed for seniors and that follows the principles of universal design. According to Haugh (2014) the Claris Companion is a promising solution to help seniors with improving their medication adherence.

The Claris Companion has a senior-friendly design (refer to Appendix B) that includes large buttons, amplified sounds and large screen text to accommodate the physical effects of aging. The Claris Companion is always on, thus PWD can always get notifications that are automatically projected onto the full screen, in a timely manner using push forward technology. The device has reminder, leisure and communication functions. The reminder functions include reminders for medication, medical treatments (ex: glucose testing) and events. The leisure functions include viewing personal photos and videos as well as a pre-loaded exercise video. The communication functions include emails and text messages that can be sent directly to and from the device, a ‘call me’ function that alerts the caregiver to call the user, a ‘check-in’ function so users could check-in with their caregivers throughout the day and a ‘video-calling’ function.

The Claris Companion can be managed online by the caregivers using a smart phone or any device connected to the Internet (refer to Appendix C). Its functionality can be personalized to the needs of the PWD. The caregivers can also receive daily text messages or emails to get daily summaries of the activities performed by the PWD. Furthermore, they can be notified via text messages and emails that immediately signal any abnormality in reporting.

3.2 Claris Companion and Principles of Universal Design

The Claris Companion is designed to look like a digital picture frame. When it is on standby, there is a slideshow of the pictures that are uploaded on the device. Thus, it adheres to the first principle of universal design because it does not look stigmatizing.

The caregivers can remotely personalize the device to meet the needs of PWD. They can control the number of active functions and the number of buttons that appear for each function. Thus, it adheres to the second principle of universal design allowing the caregiver to accommodate the device to the cognitive impairment of the PWD.

The functions of the Claris Companion are relatively straightforward. For example, the “call me” and “check-in” functions allow PWD to contact their caregiver by simply touching the button with their caregiver’s name on it. Thus, it adheres to the third principle of universal design.

Caregivers are able to remotely customize the name of the buttons on the screen so that their associated function could be more easily understood by the PWD. Thus, it adheres to the fourth principle of universal design.

PWD are not able to change the settings of the Claris Companion. Furthermore, the button to turn the device off can only be accessed using a special tool that is not provided to the PWD. This ensures that the device is always on so that notifications are always received in a timely manner. Thus, it adheres to the fifth principle of universal design.

The buttons on the Claris Companions are very big. This ensures that PWD with dexterity problems will still be able to use the device. Thus, it adheres to the sixth principles of universal design.

Caregivers can remotely change the volume according to the level of hearing of the PWD. The size of the on-screen text is also very large. This ensures that PWD with vision and auditory problems are able to adequately use the device. Thus, it adheres to the seventh principle of universal design.

3.3 Theoretical Model: Technology Acceptance Model

Many models guide our understanding of why individuals might use new technology. Most of the more notable theories are rooted in psychology and explain how individuals arrive at a change of behaviour. For instance, the theory of reasoned action - TRA (Fishbein and Ajzen, 1975) suggests that an underlying motivation for change is necessary to guide behaviour. Behaviour, in this sense, is determined by behavioural intention which in turn is determined by both behavioural beliefs (i.e. our own evaluation about whether or not to perform a particular behaviour) and social norms (i.e. the observations we make of others around us about whether or not to perform a particular behaviour).The Theory of Planned Behavior - TPB (Ajzen, 1991) extends the TRA by adding an additional determinant of behavioural intention which is behavioural control

(i.e. internal and external constraints in performing specific behaviours). The TPB offers excellent suggestions describing where and how our belief systems can influence how we plan to change our behaviours. Our belief systems, of course, are influenced by what we observe around us and the pressures that we feel imposed upon us. The notion that external pressures or influences can guide behaviour is further explored in another theory; Social Cognitive theory – SCT. In SCT, Bandura (1986) describes behaviour as having a reciprocal relationship between personal factors (i.e. internal factors such as self-efficacy) and environmental factors. While all these theories are useful in explaining why and whether individuals might change their behaviours, they are not specific to describing behaviour change associated with technology. Furthermore, the stigma and limitations associated with the impact of a disease such as dementia, might be less conducive to these models as the types of environmental pressures experienced by these populations are not typical of the average population. For these reasons the Disability Creation Process Model (Fougeyrollas, Cloutier, Bergeron, Côté & St-Michel, 1999) and the Technology Acceptance Model (Davis, 1985) were the preferred models of choice. The Disability Creation Process model breaks down the environmental factors into twelve factors (see section 3.3.1). On the other hand, the Technology Acceptance Model unwraps the concept of behavioural belief by incorporating some of the notions incorporated in previous models, including the concept of behavioural control (see section 3.3.2).

3.3.1 Disability Creation Process (DCP) Model. According to the disability creation process model (see Figure C), the presence of a disabling situation can reduce, if not adapted, the ability of the individual to perform their day-to-day tasks and social roles

(Fougeyrollas, Cloutier, Bergeron, Côté & St-Michel, 1999). This process is dynamic and evolves over time.

The model illustrates how human functioning can be influenced over time, not only by disease processes but also by environmental obstacles and facilitators. The interest of using this model is that it is the result of an international effort to determine areas of life participation; thus rendering its use in studying the impact of dementia, relevant.

The twelve areas of life habits include complex activities such as nutrition, fitness, personal care, communication, housing, and mobility, as well as social roles such as responsibility (e.g. financial), interpersonal relations (e.g. marital), community, education, employment, recreation (e.g. sports) and other habits.

3.3.2 Technology Acceptance Model (TAM). The technology acceptance model (refer to Figure A) describes the factors that come into play when people are introduced to a new piece of technology that influence how and when they will use it (Davis, 1985). According to this theory, since new pieces of technology are complex and an element of uncertainty exists, people form attitudes and intentions towards trying to learn to use the new technology prior to initiating efforts directed at using them (Davis, 1985). A person's attitude has two determinants: perceived usefulness and perceived ease of use (Davis, 1989). Perceived usefulness is the degree to which technology meets the needs of its end users. Perceived ease of use is the degree to which the use of a piece of technology is intuitive for and does not require much effort from the end users. The attitude, in turn, will affect the behavioural intention of the end users, which will

determine how and when they will actually use the new piece of technology. TAM is still widely used to assess ICT use in healthcare (Holden & Karsh, 2010).

Over the years, researchers proposed many extensions to TAM by adding a variety of different determinants of usefulness and ease of use (Li, 2010). Rose and Fogarty (2006) surveyed older adults (i.e. fifty years or older) regarding which determinants best predicted their use of self-service banking technologies (e.g. ATMs). Participants were randomly selected from the Queensland Senior Database in Australia. The survey, consisting of a five point Likert scale, was sent to six hundred individuals. Two hundred surveys were completed. A path analysis revealed that self-efficacy, technology discomfort, perceived risk, personal contact and subjective norms were the most representative determinants of usefulness and ease of use for this demographic.

Perceived ease of use has a direct effect on the intention of an individual to use a device. It also has an indirect effect on perceived usefulness. Thus, perceived ease of use is an initial hurdle in using a device. When an individual gains experience in using the device, this hurdle can be overcome. Therefore, gaining experience in using a device will change the user's initial perceptions of usefulness and ease of use. According to Venkatesh (2000), this process happens through 'anchoring and adjustment'. Anchoring is initiated when an individual becomes familiar with a device through general information such as the media. Adjustment takes place through direct experience that an individual gains by using the device. In the context of TAM, there are four anchors: control, motivation, emotion and social norm (Rose & Fogarty, 2006).

Control is the ability of an individual to regulate their performance of a specific task (Vankatesh, 2000). It requires that the individuals believe that they possess the skills required to perform the task and that their external environment enables them to do it. Control can therefore be intrinsically driven (e.g. self-efficacy) or extrinsically driven (e.g. environment). As an example of intrinsically driven control, if an individual believes in their own ability to use a specific piece of technology, they are more likely to find it useful and easy to use (Vankatesh & Davis, 1996). Furthermore, the more personal contact an individual has with a device, the more likely he or she will get more comfortable with it. On the other hand, as an example of extrinsically driven control, privacy is a perceived risk that is not as much under one's control (Wang, Wang, Lin & Tang, 2003). An individual may be concerned that their private information may be breached. Even if one has tried to secure their technological device as much as possible, there is still a chance that it may be hacked. Thus, a person may find a non-technological alternative to be more useful. Furthermore, with increased security there is an increasing number of passwords and answers to security questions that need to be remembered which would make the piece of technology harder to use.

Motivation is the drive to perform a specific task (Vankatesh, 2000). It can also be intrinsically driven (e.g. self-satisfaction) or extrinsically driven (e.g. punishment or rewards). In the context of TAM, if a piece of technology is easier to use, it becomes a form of intrinsic motivation. The easier the technology will be to use, the more likely an individual will enjoy using it for their own satisfaction. On the other hand, if a piece of technology is deemed to be useful, it becomes a form of extrinsic motivation. An

individual will get rewarded when that specific piece of technology meets his or her needs.

Emotion is a strong feeling deriving from one's circumstances (Vankatesh, 2000). Anxiety is the feeling of fear or unease that can be experienced by an individual when he/she tries something new. In the context of the TAM, anxiety about using a new device will take up a lot of cognitive energy. Thus there will not be as much cognitive energy left to fully process how the device works. As a result the device may seem to be harder to use than it actually is.

Subjective norm is your perception of what people who are important to you think about the performance of a specific task (Vankatesh & Davis, 2000). An individual may perform a specific task that he or she does not want to perform just to please people who are important to them. In the context of TAM, although an individual may not be initially open to trying a device, he or she may try it for the sake of their loved-one. Therefore, although the individual may not initially find the device to be useful, with experience and the support of his or her loved one may start to appreciate the device more and more.

The research in this area is still in the very early stages, thus qualitative studies are needed to help identify the most appropriate ways to answer to the pressing needs of PWD and their caregivers (Olsson, Engström, Skovdahl, & Lampic, 2012; Rosenberg, Kottorp, & Nygård, 2012; Rosenberg & Nygård, 2011; Span et al., 2013). As Alwin et al. (2013) pointed out, in order to ensure that PWD and caregivers find an intervention useful, five criteria need to be met:

(i) During the planning stages, researchers should conduct a needs assessment with the PWD and their caregivers,

(ii) Caregivers should feel that they have adequately understood the intervention,

(iii) PWD and caregivers should feel that the researcher truly understood their needs,

(iv) PWD and caregivers should feel that they were getting the help they needed, and

(v) Caregivers should feel that the intervention had improved the situation for PWD.

4.0 Research Questions

1. Can people with mild to moderate dementia use a touchscreen assistive ICT device such as the Claris Companion?

2. How useful would an assistive ICT device such as the Claris Companion be for people with mild to moderate dementia and their caregivers for addressing their pre-identified needs?

5.0 Objective

The objective of this thesis is to examine the usefulness (the extent to which pre-identified needs are met) and usability (ease of use) of the Claris Companion in assisting PWD and their caregivers. This project will compare their initial perceptions regarding the usefulness and usability of the tool prior to and following actual use of the device.

6.0 Methods

The study used a multiple case design involving dyads of PWD and their most significant care partner. Figure B illustrates the process used for participant selection and summarizes the procedural design.

6.1 Participants

6.1.1 Recruitment. Participants were recruited from the Alzheimer Society of Ottawa and Renfrew County, the Elizabeth Bruyere Hospital Memory Disorder Program, Perley and Rideau Veteran and Health Center, Geriatric and Psychiatry Community Services of Ottawa, and Bruyere Village and family physicians in Ottawa. Three recruitment methods were used. First, flyers were distributed to all participating locations and posters were placed in the elevators at Elizabeth Bruyere Continuing Care. Second, the charts of patients from the Elizabeth Bruyere Hospital Memory Disorder Program, who had consented to be contacted for research, were reviewed. Third, a presentation was given to three Alzheimer Society of Ottawa and Renfrew County caregiver support groups. The aim of the presentation was to inform potential participants about the study. Restrictions on number of Claris Companion units available and time constraints restricted the sample size to no more than twelve participants (six patient-caregiver dyads) for the purposes of this pilot project.

6.1.2 Inclusion criteria. Six dyads were recruited on a first come/first serve basis according to the following inclusion criteria:

1. Diagnosis of dementia is self-disclosed by participant and confirmed by a Mini Mental State Examination (MMSE) with a score between fifteen and twenty-five. The range

for mild dementia in this test is twenty to twenty-five and the normal range for moderate dementia is ten to twenty (Perneczkyet al., 2006).

2. The person with dementia is living in the community (home or senior residence).

3. The caregiver agrees to be in daily contact with the PWD for the duration of the study.

4. The PWD and their caregiver are able to speak and understand English.

5. The PWD has no physical or sensory restrictions that would prevent him or her from using the device (see section 6.2.4).

6. The PWD has wireless Internet access at home.

7. The caregiver has access to a smartphone and/or other mobile device to receive communications from the Claris Companion.

6.1.3 Screening process. There were several steps involved in the recruitment process (see figure B). First, when a caregiver showed initial interest in the study, the inclusion criteria were reviewed with that caregiver to ensure that the criteria were met. An appointment was subsequently scheduled for the principal researcher to give a one-on-one demonstration of the functions of the Claris Companion to the dyad. If the dyad was interested in participating, the consent forms were then thoroughly reviewed with them. Follow-up questions were asked to the PWD to ensure that they had truly understood the contents of the consent form. After obtaining consent, the principal researcher then administered the MMSE to the PWD. If the PWD scored between fifteen and twenty-five, an appointment was scheduled to conduct the needs assessment

interview. Following this, another appointment was scheduled for the principal investigator to train the PWD and their caregiver on how to use the device and its associated website. During this training session, a functional test (see section 6.2.4) was performed on the PWD. If the PWD passed the sensory and physical ability test, then they were able to participate in this study.

6.1.4 Demographic information. Five dyads completed the study (see Table 1) and one withdrew in the midst of the six-week trial. Three of these dyads were composed of PWD and their spousal caregivers while the remaining two were composed of PWD and their adult children caregivers. Three of the PWD were female and two were male. The MMSE scores of the PWD ranged from 16-25.

6.2 Assessment Tools

6.2.1 The mini mental state examination. The Mini Mental State Examination or MMSE (Folstein, Folstein, & McHugh, 1975) was used to determine the level of cognitive functioning and eligibility of dyads to participate in testing the tool.

6.2.2 Interview guide – needs assessment and impact of dementia.. An interview guide was developed in order to capture information about the impact of dementia on the participants' lives. The Disability Creation Process Model (Fougeyrollas, Cloutier, Bergeron, Côté & St-Michel, 1999) was used to structure the areas of inquiry.

Open ended questions were designed to explore the impact of dementia on these twelve areas of life participation (see Appendix A). The questions allowed us to evaluate the perceived needs of the PWD and their caregiver. It was developed following preliminary analyses of the first two dyads' data and following consultation with the Thesis Advisory Committee. Hence, data on these items was not gathered for the first two dyads.

6.2.3 Pre-post trial structured interview questionnaires. A second and third structured interview questionnaire were developed to assess the participants' perceptions of the usability and usefulness of the Claris Companion tablet (See Appendices B & C). The pre-trial interview questions explored the perceived expected benefits of the tool as well as the expected use of the various tool functions. For dyads 3, 4 and 5 participants were asked to reflect on how the tool might respond to the needs identified in the needs assessment. The post interview questions were designed to explore perceived usefulness and usability of the Claris Companion after a six-week trial.

6.2.4 Functional test. In order to screen for functional limitations that may affect usage of the Claris Companion, a simulated "test" with the tool was administered. As part of the training session, caregivers were asked to write a simple message to the PWD, after which, a notification sound was heard from the Claris Companion. It was then possible to see if the PWD was able to hear that sound. The PWD was then asked to read the message and reply to the caregiver by writing his or her own message using the Claris Companion. This short test allowed us to eliminate those participants who could not use the basic functions of the Claris Companion because of hearing, visual, dexterity or severe cognitive limitations.

6.3 Procedures

As summarized in Figure B, the participants engaged in a series of steps designed to evaluate the usefulness and usability of the Claris Companion. Prior to commencing the study, PWD were assess using the functional test described above and the Mini Mental State Examination or MMSE (Folstein, Folstein, & McHugh, 1975) to assess cognitive function.

During the second visit, for dyads 3, 4 and 5, a needs assessment interview was conducted with each member of the dyad individually. The caregiver was interviewed to obtain a better understanding of the impact of dementia on themselves and their resulting needs as well as their perceptions of the impact of the dementia on the PWD and their ensuing needs, (i.e. caregiver as proxy). At the same time, a second student investigator interviewed the PWD with the same questions in order to determine the PWD's own

perceptions of the impact of dementia and needs. This enabled both participants to speak freely without the other member of the dyad in the room.

On a subsequent visit, training was provided to the caregiver and the PWD. The Claris Companion User Guide was thoroughly covered to train the PWD and their caregiver about the system and operation of the device and any questions or concerns that arose were addressed. The Claris Companion Manager's Guide was thoroughly covered to familiarize the caregivers with the website that controls the degree of functionality of the device and any questions or concerns around those issues were also addressed. The caregiver and PWD were then administered the Pre-trial structured interview together (see Appendix B) to identify their initial perceptions of the potential usefulness and usability of the tool. The exchange was recorded using an audio recorder. The device was then left with each dyad for a six-week period. The PWD and the caregiver were contacted by telephone on a weekly basis in order to ascertain whether they had experienced any problems with the device or had any questions or concerns.

At the end of the six-week period, the device was collected from the dyad and the caregiver and PWD were interviewed using the Post-trial structured interview (see Appendix C) to identify how their perceptions regarding the usefulness and usability of the tool had changed from the expectations pre-trial. With the dyad's permission, access was given to log files about the frequency of the type of activities performed by the person with dementia on the device or the caregiver on the website over the period of six weeks.

6.4 Data Analysis

The analyses in this study had both a quantitative and qualitative component. Frequency counts were tabulated for device use based on logs obtained from the management system. All interviews, including the needs assessment, pre-trial and post-trial interviews were analyzed using content analysis.

6.4.1. Qualitative analysis of the interviews. All interviews were audio recorded and transcribed verbatim. They were then imported into the NVIVO (QSR International, 2016) qualitative software. Each participant/ interview combination was given a confidential code using a three-digit number. The first digit corresponded to the dyad number. The second digit corresponded to the type of interview conducted: (1) needs assessment, (2) pre-interview, (3) post interview. The last digit corresponded to the dyad member: (1) PWD, (2) main adult caregiver, (3) spousal caregiver, (4) secondary adult caregiver.

The data from the needs assessment was coded according to whether it pertained to the PWD, the caregiver or the caregiver as proxy for the PWD. The answers to the questions were further coded into whether they described the impact of the dementia or whether they described the strategies or accommodation used to minimize the impact of dementia (refer to Table 2). The data that was coded as an accommodation referred to different means used by the PWD or their caregiver to accommodate to the disease and the resulting impairments. The data that was coded as an impact referred to the impact that dementia has had in the life of the person affected by this disease or on their

caregiver. The Disability Creation Process categories of life habits helped to structure the responses.

The data from the pre and post interviews were coded into four parts (refer to Table 2). The first part of the code referred to whether it pertained to the PWD, the caregiver or the caregiver as proxy for the PWD. The second part of the code referred to whether or not the tool was usable and useful. The third part of the code referred to one of the Claris Companion functions. The Claris Companion features were classified into communication, leisure, reminders, user interface or overall usability. The last part of the code referred to the specific impact (as identified by the needs assessment) that a particular Claris Companion function did or did not meet.

After the aforementioned coding scheme was established, the codebook and uncoded transcripts were given to a second coder. The codes were compared and adjusted accordingly. In order to reduce the codes, the three main members of the research team consulted with each other and carefully examined each code and their associated quotes. The final codebook contained thirty-seven codes (refer to Table 3). Lastly, a frequency table was created indicating the number of sources (number of different transcripts that referenced a particular code) and references (number of times a particular code was referenced within the same transcript) for each code (refer to Tables 4-8).

6.4.2 Quantitative analysis of the log files. A log file was obtained for each dyad with the following information: the function used (e.g. messages), the action performed (e.g. sending message vs. receiving message), and the date/time each action was performed. Based on the information contained in these log files, bar graphs were created

and grouped according to the area which they targeted: reminders, leisure or communication. The functions that fall under the area of reminders are the reminders for medication, treatment and events. The functions that fall under the area of leisure are web browsing, photos, videos and exercise. The functions that fall under the area of communication are audio/video calls, messages, call-me, check-in and surveys (including wellness surveys). A graph was plotted for each area with all its respective functions for each dyad.

7.0 Results

The results will first be discussed in terms of the perceived impact of dementia and subsequent identified needs, followed by the results of the pre and post-trial interviews. The quantitative results based on the acquired log files will be presented following the interview data.

7.1 Qualitative Results Based on Interviews

The qualitative results were collected at three points of interest and will be reported as a function of the time at which they were captured. The first results were gathered pre-trial and dealt with the perceptions of how dementia affected the lives of three of the five dyads. The second section summarizes the results from the pre-trial interviews which explored the anticipated usability and usefulness of the Claris Companion. Finally, the last section will report on the data stemming from the last, post-trial interview.

7.1.1 Impact of dementia and needs assessment. The objective of the preliminary interviews was to obtain information on the perceived impact of dementia on the lives of the PWD-caregiver dyads. As previously mentioned, this portion of the study was added once the first two dyads had already begun their trials with the device. The results for this section stem from interviews with dyads 3, 4 and 5. The results suggest that the impact of dementia and functioning could be regrouped around five large themes, using the Disability Creation Process Life Habits (Fougeyrollas, Cloutier, Bergeron, Côté & St-Michel, 1999). categories as a starting point: activities, fitness, interpersonal relationships, nutrition and financial responsibilities. Each will be reported individually in the following sections.

7.1.1.1 Activities. As can be expected, participants noted the significant impact dementia had on the PWD's abilities to perform daily activities. This was especially evident in the areas of recreation, driving, employment and household chores and less evident overall in the areas of appliance use, grocery shopping and medication administration (see Table 4).

Dementia was reported to affect both the PWD and their caregiver's ability to partake in recreational and community activities. For instance, the fourth dyad noted how dementia affected their ability to travel. Having been avid travelers, participant 413 (a caregiver) feels that it has become increasingly difficult to do so since the onset of dementia:

> "The last time we did it; I couldn't get her out to do anything. We went to a cruise, so that should be easy because all the stuff is in one place. But we couldn't get off the ship half the time because we couldn't meet the deadlines [timing deadlines in terms of when to leave and get back to the cruise]."

The driver's license of all three PWD was revoked leaving both members of the dyad with reduced independence. One PWD (participant 411) noted "I'm not allowed to drive. I've been driving for fifty-five years and then they took away my freedom big time." The inability to drive affects the caregiver as well as they have to take over this function. For instance, participant 413 (the caregiver from the same dyad) added: "She has an 87-year-old mom who is still pretty active. She's still driving around and doing all this stuff. This aggravates [411] because she needs to ask her mom to drive her because she can't do it herself." This sentiment of loss of independence was echoed by participant 313 (a caregiver) as can be illustrated by the following quote: "Well, I have to drive him

everywhere, I have to walk him everywhere and I can't leave him somewhere unless it's a program. So he used to have more independence, but he doesn't anymore."

Dementia affected both the PWD and the caregiver's ability to work. Two of the three PWD were no longer able to work because of the dementia. Participant 411 (a PWD) used to be a caterer but gradually lost those skills as can be illustrated by the following quote by participant 413 (her caregiver): "She would forget steps, she would forget things, couldn't organize things, and couldn't find things. She would also do things five times, whereas before she would whip through it." Participant 311 (a PWD) used to be a French teacher in an elementary school. However, when he got the diagnosis and started losing his voice, he was given a disability leave. Participant 511 (a PWD) retired before his diagnosis.

Most caregivers had to take over most housekeeping chores in terms of the maintenance of the inside of the house (e.g. dishes, laundry, vacuuming) as well as the outside (e.g. snow removal, lawn mowing, gardening) of the house.

According to their proxy, PWD had difficulty in using household appliances although this was mentioned less than the other activities. For instance, participant 311 (a PWD) could no longer use any of the kitchen appliances with the exception of the microwave as can be illustrated by the following quote: "The only kitchen appliance he can really use fully is the microwave; but things like a coffee machine he can turn on but he can't run it with all the necessary steps."

Some PWD needed help with grocery shopping. Participant 413 (a caregiver) let the PWD do the grocery shopping with the hired caregiver and participant 513 (a caregiver) went grocery shopping alone because she found it faster.

Two dyads expressed how the PWD needed assistance in taking their own medication but the impact was not overwhelming, as compared to the other needs. For instance, participant 313 (a caregiver) had to closely watch participant 311 (the PWD) from the same dyad) as he was taking his medication as can be illustrated by the following quote:

> "[The medications] have to be put out and even when they are put out I have to watch that he does it because he can get distracted and not take them. He's also dropped things and not noticed that he dropped them so I had to watch that."

7.1.1.2 Interpersonal relationships. Another important impact of the dementia was felt to be in the area of interpersonal relationships. This category included data that referred to the ability of the PWD to interact with others. The most meaningful impact was on the marital relationship and their ability to communicate as well as on the relationship the PWD had with his/her family. Friends were also affected, but the circle of support seemed to have been reduced to the family following the onset of dementia (refer to Table 4).

All three dyads who participated in the needs assessment interviews, identified dementia as having an impact on their marital relationship. In the caregiver's perspective, participant 313 shared how she feels like she was no longer a spouse but just a caregiver: "Well I'm pretty much still a caregiver at this point and it totally changed our marriage. He sleeps down here. I don't sleep down here but I sleep back upstairs. So that's where it's at. I'm just a caregiver." From a PWD's perspective, participant 411 felt that her husband is not very supportive and understanding about her condition as can be illustrated by the following quote: "It's harder for me and it's harder for my husband. There is a lot of

fighting that has been going on. I understand, I mean for him he works so hard and sometimes he doesn't understand what I'm going through."

In fact, caregivers discussed their transition from being a spouse to becoming a caregiver as having been subtle. It took time for participant 513 to accept that transition but after speaking with friends, she has come to realize that her role is indeed different now: "Well about three years ago, somebody was asking about [511] and said "so you are a caregiver" and I had never thought of it in that term before; but I guess I certainly am now."

The marital relationships were often affected by a problem with communication. Participant 311's communication difficulties have further impacted the marital relationship as can be illustrated by the following quote by participant 313 (their caregiver): "Oh well it's just terrible not to have him be able to converse with me. It's very frustrating and lonely of course. It took me a long time to learn to adapt to it." Participant 413 also voiced how communication affected their relationship:

> "Well it's hard to have a conversation with [411] because she goes off on tangents. She says you said that and you didn't say that and you meant that. So there is no discussion about anything. So, that's gone. I just can't say what I want to say. So it's about having fewer things to make decisions on."

Some caregivers specifically mentioned the impact of the communication difficulties they experience when interacting with the PWD in general. This issue was most apparent with participant 311 (a PWD) and participant 411 (a PWD) who had communication difficulties. For instance, participant 313 (the caregiver) shared that participant 311 (the

PWD) has trouble with the processing of information relayed to him as can be illustrated by the following quote:

> "He can get the information but he can't do anything with it. He can't process or he doesn't show that he's processing and so then he doesn't know how to respond to something. So he gets it all but he doesn't know what to do with it and so he can't move forward."

The relationship with non-spousal family members changed to varying degrees. Participant 311's (a PWD) family members did not interact with him much during family gatherings; thus, participant 313 (the same dyad's caregiver) has to interact for the both of them as can be illustrated by the following quote:

> "There would be no involvement with the family if I didn't bring him and when he's there nobody interacts with him. So I stay with him the whole time…They might make some initial contact but really they have no idea [how to interact with him]."

On the other hand, according to participant 413 (a caregiver) things have not changed much as for participant 411 (the same dyad's PWD) as can be illustrated by the following quote:

> "Well [family dynamics] still work the same way. You know she still hugs and kisses the kids and all that kind of stuff but as far as communicating she has a hard time processing thoughts. But sometimes she's smack on. Like she talked to my granddaughter about going to university the other day and she was pretty good you know. Some of her thoughts were a little strange but that's just that some thoughts

were strange. She didn't have any trouble in communicating what she was trying to say."

There was a profound impact on friendly relationships which included anyone outside the family such a friends and colleagues. Participant 311's (the PWD) relationships outside the family were largely work-based. He felt that his disability leave "shrunk his social field". Participant 411 (a PWD) stopped interacting with others because she was really self-conscious about the double-stigma of having dementia and communication difficulties. On the other hand, participant 513 (a caregiver) had so much to do with all the added responsibilities she acquired and thus does not have time interact with others as she would like.

7.1.1.3 Fitness. The toll of caring for someone has been felt in many areas including the ability to stay physically and mentally fit. The specific themes that fell within this category were: mental fitness, physical fitness, sleep and spirituality (refer to Table 4). It is important to note that mental fitness, in the context of the Disability Creation Process Model, includes items such as mental relaxation.

Dementia significantly impacted the mental status of both PWD and their caregivers. The caregivers had difficulty in dealing with gradually losing the PWD as can be illustrated by the following quote by participant 313:

"But really, you know it's not just stress but it's pretty devastating to lose your partner this way. You know he's not really able to relate to me as a friend and as a husband. So I have to face that loss day-by-day, moment-by-moment. It's very devastating most of the time."

Moreover, PWD also had trouble dealing with their diagnosis and the gradual deterioration of their skills as can be illustrated by the following quote by participant 411: “It’s impossible for someone to be happy and you can’t talk, you can’t walk, you can’t communicate, you can’t pick up a phone.”

Dementia mostly impacted the physical fitness of the PWD. Participants 311 and 411 were regularly going to the gym, while participant 511 was an avid golf player. However, since their diagnosis their physical activity was limited to walking with their caregiver for participants 311 and 511 and limited to horseback riding for participant 411. The following quote by participant 413 (a caregiver) illustrates how participant 411’s (the PWD of the same dyad) physical fitness has changed since her diagnosis: “She doesn’t work out on her own. We have a gym downstairs and she asks if she could do it with me and she either doesn’t show up or she can’t remember the exercises.”

7.1.1.4 Nutrition. The impact of dementia on the life habit of nutrition was minimal in terms of the responses of the current participants to the interviews. This category included data that referred to the impact on the PWD ability to feel hungry (appetite), be able to eat (use of eating utensils and table manners) and meal preparation (refer to Table 4). The aspect of nutrition that was the most impacted was meal preparation. All three caregivers mentioned that the PWD would inadvertently leave the kitchen in disarray when attempting to prepare a meal, thus leaving more work for the caregiver as can be seen in the following quote by participant 313 (a caregiver): “He can’t cut things up properly. He doesn’t clean up. He doesn't see the messes he makes. So if he dropped something, it will just get squished around the floor.”

7.1.1.5 Financial responsibilities. The role of the caregivers was further burdened through their additional financial responsibilities. The female spousal caregivers (313 and 513) assumed the financial responsibilities from the PWD. This was a learning curve for them, as they were pushed into this new role and could not rely on their husbands to help them. On the other hand, not much had changed for the male spousal caregiver (413) as he continued to assume his role in handling all finances.

In summary, the three dyads who participated in the interviews that explored the impact of dementia, reported that their lives had changed in relation to the activities they engaged in such as recreation, driving, employment and household chores. They found a significant impact on all interpersonal relationships and on their mental state. Their strategies for accommodating to these changes involved reliance on the spouse for the person with dementia and reliance on community services for the caregivers.

7.1.2 Pre-trial interviews. The purpose of the pre-trial interviews was to obtain some understanding of the expected views of the study participants vis-à-vis the usability and usefulness of the tool. Data was obtained from all five dyads and will be reported as a function of both the usability (refer to Table 5) and usefulness (refer to Table 6) of the device.

7.1.2.1 Expected usability of the device. Participants were asked about the perceived ease of use (i.e. usability) of the device in terms of the communications, leisure and reminders functions as well as about the user interface. In general, participants were hesitant to comment on the perceived usability of the device given that they were only

exposed to the Claris Companion during the training. The number of references to these issues was therefore low.

Most participants were impressed by the Claris Companion's user interface. They appreciated the button customization feature, the screen and the text size. Caregivers and PWD enjoyed the fact that extraneous buttons could be removed and that they were large enough to be easy to use even for those with dexterity issues. They also mentioned that the screen size would be more likely to be usable than a smaller screen such as those found in phones. While the wooden frame had been designed to resemble a picture frame (i.e. less stigmatizing), one dyad was quite vocal about how this visual component could be improved, as can be seen by the following quote by participant 124 (a caregiver):

> "I would get rid of this horrible wooden thing. I think it's heavy, I think it's awkward. I understand you want something they can grip…So my point is that you could design the casing a little better than what it is. I know they have the built-in speakers, that don't work very well; it kind of muffles the sound. I think the actual design of it not the software part, the physical part is not very good. I think it's awkward and it's heavy and I think they could do a much better job with plastics or rubber."

The usability of other functions was only mentioned in passing. Regarding the communication functions, participant 423 (a caregiver) was optimistic about the call-me function: "the call me function is definitely great and simplifies calling tremendously by reducing the steps down to just the click of a button.". Participant 421 (a PWD) added that "[she] think[s] that should probably be easier than having to remember people's numbers." However, participants were less optimistic about the audio/video calling function. Some

were worried about its compatibility with certain internet browsers and with desktops and laptops. One participant was also concerned about the messaging function given their lack of experience with keyboard typing.

Regarding the leisure function, the only function that participants commented on was web browsing. For instance, participant 124 (a caregiver) found that the scrolling ability of the website was really slow as can be seen by the following quote:

> "[The website feature] is awkward to scroll…like you know I found it awkward too, the screen is just, I think because it's framed in so sometimes the cursors are on the side and I find that it's hard to navigate websites on that tablet."

The only reminder function that the participants commented on was event reminders as can be illustrated by the following quote by 423 (a caregiver):

> "With regards to events, I already use a paper calendar and Apple calendar. The Apple calendar syncs all devices to make sure we are all on the same page…But I mean we can still try to use it but it will depend if we remember to input the events".

7.1.2.2 Expected usefulness of the device. Participants were also asked pre-trial about the perceived usefulness of the device in meeting their needs.

Most participants expected the event reminders to be useful, especially with regards to recreational activities for the PWD. For one dyad, the electronic nature of the tool was seen as an added value. For instance, participant 321 (a caregiver) further specified that:

> "The reminders would be a good basic function by putting the schedule on a screen because [321] really likes the screen. I mean this is really [321]'s medium, so instead of me just putting things on paper, I think a screen with little bells and whistles are going to be good for him."

Having an electronic tool to help remind them of events was not expected to be terribly useful to all participants. Participant 221 (a PWD) did not expect it to be useful because "[she] feel like [she's] just doing the things that [she] usually does." However, participant 222 (a caregiver from the same dyad) added that "[she] feel[s] that if there were a lot of appointments in the future, [she] thinks that would help."

Most participants expected the photos to be useful. For instance, participant 423 (a caregiver) felt it would help make 421 (the PWD from the same dyad) feel more included in the lives of their children and grandchildren as can be illustrated by the following quote: "Pictures and videos should definitely be great, it will help her feel more included in the family and that she gets to share those precious moments and relive them when looking at the device."

The reaction to the usefulness of the check-in function was mixed. On the one hand, participants felt it might prove to be useful to keep the connection between the two members of the dyad. However, there were other ways to communicate such as messaging a check-in using the emails and text messages function, which might render the "check-in" function less interesting. For instance, participant 423 (a caregiver) expected it to be useful while he was at work as can be illustrated by the following quote:

> "With me at work 4 times a week, I really think that the check-in will be useful, especially if I program them to come at specific times. Then if she doesn't respond I will know that I should message her or call her."

Some participants expected the call-me function to be useful. For instance, participant 323 (a caregiver) expected the call-me feature to be useful if she ever needs to leave 321 (the PWD) home alone as can be illustrated by the following quote: "Well, I don't leave [321] alone that often, but when I do, if he needs to contact me, that's another way." 421 (a PWD) expected to use it because "[she] also get really embarrassed when [she] call people and catch them at a bad time and so [they] have to cut the conversation short." 521 (a PWD) expected it to "make it easier for [him] to communicate more regularly with [his] children."

Some participants expected the audio/video calling function to be useful. For instance, Participant 323 (a caregiver) expected the audio/video call to be useful "because it would be a great way to communicate with family abroad" and 523 (a caregiver) thought it would be a great way to specifically communicate with their children living abroad. On the other hand, participant 421 (a caregiver) did not expect the audio/video calling to be useful because "[she] think[s] people might prefer to just call [her] on [her] home phone because it is how they have always called [her]."

The same could be said about the sharing of videos through the "video" function. Most participants expected the videos to be useful. For instance, participant 421 (a PWD) thought it could be useful in the context of family as can be illustrated by the following

quote: “Yeah, I think I will use that especially with my daughter and grandchildren. This could be a good medium for them to share important moments in their lives.”

Participant 421 (a PWD) expected the email/text messaging function to be useful in overcoming her communication difficulties as can be illustrated by the following quote:

> “I think I am probably going to use the messaging function quite a bit because I think it may potentially be helpful for me in helping me communicate with others more easily. It may take me a bit of time to learn but I think it may potentially help me overcome my communication issues and grow my social circle. I think texting will be especially useful with my grandchildren.”

On the other hand, participant 521 (a PWD) felt that calling would be easier.

The exercise video and the Q&A functions of the Claris Companion were not expected to be useful. The participants in this study were quite mobile and had other ways to engage in physical activity than to follow a tablet-based exercise program. They used their gyms at home or went for walks with the caregivers. As for the Q&A function, participants felt that there were other ways to use the Claris Companion to answer to this function (e.g. email and text message function).

Some participants expected medication reminders to be useful. For instance, participant 423 specifies that “the medication reminders would be useful, at least for [him]. Going back to that concept of peace of mind that [421] has indeed taken her medication instead of always having to double-check.” On the other hand, other participants did not

expect the medication reminders to be useful because the PWD did not have problems in remembering to take their medications; some having access to blister packs.

In summary, the data from the pre-trial interviews revealed that it was difficult for participants to estimate whether the functions of the Claris Companion would be easy to use, given that they had only had access to the tablet during the training session. In fact, the majority of comments revolved around the user interface. Participants expected that the size of text, the flexibility of the button interface and the size of the screen would all help in using the tablet. In terms of usefulness, the bulk of the comments were captured around the potential ability of the tool to remind users of recreational events, and the sharing of photos and videos with family. There were mixed reviews of anticipated usefulness of the "check-in", "call-me" and "audio-video" functions. Participants seemed to see the potential in these tools but there appeared to be a sense of preference as to which they would use to communicate.

7.1.3 Post-trial interviews. The objective of the post-trial interviews was to inform the study with regards to the perceived ease of use (refer to Table 7) and perceived usefulness (refer to Table 8) of the device after having used the Claris Companion for six weeks. All dyads participated in these interviews.

7.1.3.1 Perceived usability of the device post-trial. Most participants struggled with some aspect of the usability of the Claris Companion. For some the technical aspects were just not functional to them. For some of the components, it just was not practical.

In terms of the communication functions of the Claris Companion, some participants felt that the audio/video calling function was difficult to use as well as the email and text

messaging function. Participants mostly complained about browser compatibility issues and poor quality of image and sound for the audio/video aspects. The lack of spellcheck and the inability of the device to open attachments and forward messages to other contacts was an issue mentioned within the context of messaging. Others found it easy to use. For instance, participant 431 (a PWD) initially had difficulty with it, but eventually at ease with it as can be illustrated by the following quote:

> "It was kind of frustrating at first, because typing took some getting used to. However, because I felt it has so much potential, I tried to push myself to send messages to the people that [433] added at least once a day. By the end of the first week, I felt fully comfortable with typing."

Exceptionally, participant 431 (a PWD) found one of the communication functions (i.e. the call-me function) was very easy to use as can be illustrated by the following quote: "[the call-me function] was one of my favorites [functions] because it was so simple and straightforward, all you needed to do was just press a button." However, participant 333 (a caregiver) noted that "[she] felt compelled to send people an email saying that [331] might ask you to call [him] but it's not urgent. Someone might panic especially if they can't get through you know."

Reminders were also not perceived to be extremely user-friendly or practical. Most participants found the event reminders difficult to use. From the caregiver's perspective, participant 132 had difficulty with the managerial aspect as can be illustrated by the following quote:

> "So when an event is passed, it should just be automatically deleted. Like you have to go through each week and delete them. Like it's a bit chunky, it could be a little more sophisticated."

From the proxy perspective, participant 232 felt that it would have been easier if it was possible to view all the events of the same month on the screen all at once [like the paper calendars] as opposed to having to scroll though the daily events. Participant 333 added that the PWD should play a more active role when presented with a prompt as can be illustrated by the following quote:

> "Let's say [he] has a doctor's appointment coming up or something and then as [he] gets ready, maybe there is someone he wants to ask me like what he needs to bring with him or something like that. So if you are going to make a system where you are going to use a machine, there is no way for him to interact through that feature. If he has a question, he couldn't do anything about it."

Most participants found the medication reminders function difficult to use. For instance, participant 433 (a caregiver) noted that there were proximity issues between the Claris Companion and the medication as can be illustrated by the following quote:

> "With regards to the medication reminders, the problem is that the medication is up in the bathroom cabinet while the device is down here. So she sees the reminder but then by the time she's upstairs she forgets the reason she went up. So if there was a separate small device of some sort that could maybe light up and also have the sound and have text to remind the user of the reason for the alarm."

The leisure functions of the Claris Companion were more positively reviewed in terms of usability. Participant 231(the PWD) really enjoyed using the exercise video function. 232 (the caregiver from the same dyad) suggested that the Claris Companion should have a pop-out stand and the exercise video have rewinding/fast-forwarding capabilities. Many participants found the photos function easy to use. For instance, participant 232 liked the fact that she could text pictures directly from her phone to the device. Furthermore, participant 431 (a PWD) enjoyed being able to "flip though the pictures or just see them on the slideshow."

The videos function of the tool proved to be some cause for frustration on the part of some participants. They found that there were browser compatibility issues when trying to upload a video on the Claris Companion. For instance, participant 531 found that "videos would take a really long time to load and then it would say [it was unable to load because] there was an error."

Furthermore, participant 132 (a caregiver) felt that "the websites are too sophisticated for the technology this has." On the other hand, it exceeded participant 331's (a PWD) expectations as he was able to access more websites than he expected.

Most participants found the device's user interface difficult. Some participants found the screen too small yet too bulky. This issue was especially evident in the email/text function because the keyboard would take up a big portion of the screen. Participants also found confusing that all prompts elicited the exact same sound. The caregivers saw room for improvement in the managerial function. For instance, participant 132 noted that:

> "The manager portion of it is pretty simple, it's pretty easy to figure out. But like I said for instance the calendar, after the day has passed it doesn't erase, like you have to keep updating it and changing it all the time. And I think it would be easier if there is a way for her to get emails that don't require her to be putting their address. But I guess what you would have to do as a manager is spend some time in the beginning, inputting all the contact that she potentially would want to talk to. So there is more work involved at the outset. You know what I mean. I could have done more as a manager as far as putting more pictures up and more importantly more emails addresses so that she can start receiving more emails from more family members."

7.1.3.2 Perceived usefulness of the device post-trial. Despite the issues raised in terms of usability, the participants still found the tool to respond to some of their pre-defined needs.

Most dyads found the messaging function to be useful. For instance, participant 132 (a caregiver) noted that it provided an additional channel of communication as can be illustrated by the following quote:

> "The fact that she can write an email or text on top of being able to call. So it's an extra way to communicate. So if I'm in class and I can't take a call. I can take a text. So in that sense it was good."

Participant 431 (a PWD) added that it really helped her overcome her communication difficulties and gain back her confidence as can be illustrated by the following quote: "I found that [the messaging function] really helped me with my communication difficulties because although I have trouble speaking, it was no longer an issue when typing. I almost

felt like my old self again." On the other hand, 531 (a PWD) never really used email in the past, so he did not find this function useful. So for some participants, this function helped them re-connect with family and friends.

Participant 431 (a PWD) found the audio/video calling also very useful to get back in touch with friends living abroad as can be illustrated by the following quote:

> "I have so many friends living abroad, so it was so nice getting back in touch with them. As much as I enjoyed messaging them, it was really nice to see their faces on screen and interact with them that way."

Some participants found the check-in to be useful. For instance, participant 433 (a caregiver) shared that:

> "There was a whole week [informal caregiver] was out of town. During that period, I really came to appreciate the device. I felt like it was ok to leave her home alone because I could contact her via the device. During that time, I made her check-in with me and message me regularly. I also knew that if any kind of emergency happened, I was the touch of a button away."

Participant 431 (a PWD) found the video function was also useful because it gave her the opportunity to be more present in her grandchildren's lives as can be illustrated by the following quote: "I have some very young grandchildren five years and under. My daughter would send me videos of some of their cute or funny moments. Kids at that age are so precious! I really appreciated that she shared those with me. It felt like I was more involved in their lives."

Many participants did not find the medication reminders useful. For instance, participant 333 (a caregiver) specified that the reason for this is because pressing down on a medication reminder does not ensure follow-though, that is that PWD actually took their medication. On the other hand, 331 (the PWD in the same dyad) said that he would miss it if he no longer had the device.

In summary, the data post-trial was interesting. While many participants did not feel the tool to be very easy to use or practical, they did see the merit of some of the functions that allowed them to connect with their families, be reminded of recreational activities and use the tool for leisure.

7.1.4 Dyad-specific themes. As there were only five dyads participating in this study, it is informative to look at any particular feedback that could be given from their individual experiences with the Claris Companion.

7.1.4.1 First dyad. This dyad was composed of a mother and her two daughters. The daughters thought that this device would be useful for touching base on a daily basis with their mother whereas the mother was not sure how useful the device would be. After the trial, they found that the device was indeed very helpful in keeping in regular contact with their mother throughout the day.

Overall, the daughters found that the device was very straightforward and easy to use but a bit too bulky as illustrated by the following quote from participant 134 (a caregiver):

> "I mean the nice thing about this device is that it's pretty straightforward. You know it's very user-friendly you know for people who are not technically inclined. You

don’t have to spend a lot of time to show someone how use it which is nice…But with this it’s pretty seamless. They don’t really need to do anything; they just plug it in”.

In terms of specific functions, they really enjoyed having the option to text their mother but were not satisfied with the video calling function. They complained about the quality of the image and sound. The daughters also offered feedback about the fact that the only stimuli for alerts was a sound alarm. They suggested that adding flashing lights to the sound alerts would be very helpful especially for people with dementia.

7.1.4.2 Second dyad. This dyad was composed of a mother (PWD) and her daughter. Her daughter thought that this device could be useful for her mother to keep in touch with her and her sister. Her mother was initially anxious about using the messaging function because she was not very good at typing. However, over the trial and with the support of her daughter, she used it on a daily basis. The PWD really enjoyed the exercise function and also used it on a daily basis. However, she wished the device had a pop-down stand as opposed to having to drag the charging stand wherever she exercised. Additionally, the caregiver suggested that the event reminders look more calendar-like on the screen.

Overall, her daughter said that a device like this is hard to introduce to the current generation that has not been raised with this kind of technology. Thus, her mother did not have many friends she could add to her network that use this kind of device. However, she commented that people her mother’s age might be much more open to using such devices in the future as can be illustrated by the following quote by participant 232: “In the next fifteen years, [the incoming generation of seniors] would have all used computers, so it

will be easy for us. But for [the current generation of seniors] for instance, dad only had a computer for a few months and mom has never really had one. So they are not really going to explore."

7.1.4.3 Third dyad. PWD had his driver's license revoked a year ago. This has tremendously affected his ability to go out and about in his community because he has to rely on his wife for transportation. In this particular case, the PWD also has trouble with mobility at home because he has Parkinsonian symptoms that considerably slow down his movements.

The PWD in this dyad has trouble with communication because he has difficulty with his actual speaking patterns. His wife specified that he has trouble with processing the information that is relayed to him, so it takes him a while to respond in a dialogue. The participant with PWD feels like his social field has shrunk since he took disability leave from work. In the context of a family gathering, his wife must interact for the both of them, so she is unable to fully enjoy the family time. Her only relief is when she takes advantage of respite care, at which point she goes is able to visit the family on her own.

PWD thinks that the device will serve as a communication aid while his wife thinks that it will serve as an electronic reminder. PWD acknowledged that the device indeed helped him overcome his communication difficulties since he regularly messaged his family members. Those messages also helped initiate face-to-face conversations during family gatherings. His wife also acknowledged that the reminders helped to some degree. However, they did not ensure follow-through, making their usefulness limited. When asked about how the Claris Companion can be improved, his wife said "That's a hard one. I think

basically you cannot replace people with machines." His wife suggested that alerts should have a reply button that allows her husband to comment on it. His wife also suggested that there should be different sounds for different functions.

His wife is frustrated with his addiction to electronics because he has trouble using them, so she constantly has to monitor him and help him when needed. She also needs to monitor him when administering his medication to ensure he actually follows through and takes them. She is also having a hard time dealing with the change in their marital relationship as illustrated with the following quote: "It's pretty devastating to lose your partner [due to dementia]. You know he's not able to relate to me as a friend and as a husband. So I have to continually face that loss day-by-day, moment-by-moment."

7.1.4.4 Fourth dyad. The participant with dementia in this dyad feels that she is losing her freedom. She can feel how everything is gradually slipping away from her and finds this health condition is harder to manage than previous ones. She also feels that the impact on her husband is also great, making it hard for him to offer the much needed support.

She used to be a very social person, but now she has trouble finding her words. When they are out in public, her husband tries to make up for that by speaking on her behalf and is often looked down on for doing just that. This couple is able to accommodate somewhat through formal hired help, which is appreciated by both members of the dyad.

In pre-trial interview, the PWD in this dyad thought that this device had the potential to make her more independent and function as a communication aid. On the other hand, her husband thought that this device would give him peace of mind while he is at work. If

the formal caregiver is absent, he thought he might feel more at peace leaving her home alone.

In post-trial interviews, the PWD found that the device was tremendously beneficial in helping her communicate with others. In fact, she said that it made her feel like her old social self and really helped her increase her confidence. The device did indeed give her husband peace of mind especially when the formal caregiver was absent. He suggested that there should be a separate device that has a light that flashes, a sound alarm and text that is closer to the object (e.g. medications). He also suggested that the device should be able to synchronize with other devices.

7.1.4.5 Fifth dyad. This dyad is composed of a male PWD and his wife. In their case, the dementia became evident when the PWD fell four years ago. Although the PWD is shy, social interactions are important to keeping him in really good spirits. In pre-trial interviews, his wife thought that the device would give him some independence. On the other hand, the PWD seemed to be more interested in the more social functions, particularly the call-me and the video/audio calling. After the trial, the PWD indicated that he felt that the device made him more independent and he did not have to rely on his wife as much to remind him about appointments and could easily contact people with the touch of a button. His wife indicated that the device gave her peace of mind that she could leave him home alone and that he could easily contact her and check-in with her with the touch of a button.

7.2 Quantitative Results Based on Log Files

The Claris Companion targeted three main areas of need for PWD and their caregivers: leisure, communication and reminders. Logs were obtained of the actual use

of these functions over the six-week trial. The most frequently used function for leisure was web browsing for all dyads, except dyad 2 who used the exercise video more frequently (refer to Figure D). Dyad 3 used the web browsing function more than twice the amount of time of most other users. The photo function was actually used by only 3 of the 5 dyads.

In terms of communication functions (Figure E), the function most widely used by the dyads was email/text messaging. While all dyads used this function, it was used most often by dyads 1, 2 and 3. The "Call-me" function was used by all dyads as well but to a lesser extent. It is interesting to note that PWD were not passive users of the messaging function. They took part as frequently in reading messages as in sending them out, with dyad 1 reading more messages than were sent (refer to Figure F).

The least widely used area by all dyads was reminders (refer to Figure G) which included the event reminders, medication reminders and treatment reminders functions. Only dyads 3 and 4 used these functions, with dyad 4 being the more prominent user. The medication reminders were only used by the third and fourth dyads and the treatment reminders were only used by the fourth dyad.

8.0 Discussion

The objective of this study was to explore the perceived usefulness and usability of the Claris Companion in responding to the needs of individuals with dementia and their caregivers. Individuals were first asked to reflect on the ways the dementia affected their daily lives so as to better determine the possible impact of the tool. Interviews were conducted prior to the trial use of the Claris Companion and then after a six-week period. Objective measures of actual usage were equally obtained during the trial period. The results of the study will be discussed in chronological order. f

8.1 The Impact of Dementia

The participants in the current study spoke of the impact dementia had on their ability to take part in daily activities such as recreation, driving, employment and household chores. These impacts affected both the PWD and their caregiver. The impact of the dementia also significantly impacted all their interpersonal relationships whether they be with their spouse, other family members or friends. These important impacts left the caregiver with additional burden and mental stress which could only partially be alleviated through some hired help or access to community services. These results are not foreign to the literature and are extensively cited (Kim et al, 2012). In fact, the impact of dementia on Instrumental Activities of Daily Living (IADLs) is part of the diagnostic criteria for dementia (Di Carlo et al., 2016). Therefore, it is not surprising that these themes were raised by the participants in this study when asked about the impact of dementia.

Individuals expressed a sense of loss of identity and independence as well as a reduced network of social connections; again a result found in the literature (Miyamoto, Tachimori, & Ito, 2010). In probing the potential contribution of the Claris Companion to the needs of the participants, it is clear that it is most likely to offer a solution for alleviating the stress associated with interpersonal relationships than to the burden associated with household chores. By communicating more effectively through the tablet, and by using functions related to leisure, both PWD and family members can enjoy each other's company and connect more easily.

8.2 Perceptions of Anticipated Use and Usefulness

The results of the pretrial interviews suggested that participants were unable to identify the elements of the tool that would be easiest to use. As discussed in section 2.2.1, this might be due to the lack of contact these participants had with similar tools (Rosenburg, Kottorp, Nygard, 2012), rendering their perception of its potential usability more difficult. In general, the participants hoped and anticipated that it might allow PWD to remember key events as well as contribute to the peace of mind of the caregiver by offering some mechanism of communication between the two members of the dyad. It was also anticipated that the sharing of photos and videos would contribute to the strengthening of interpersonal relationships. So while there was some uncertainty about its eventual usefulness, participants, in general, did not perceive overwhelming discomfort with attempting to use the technology which is why they accepted to take part in this study.

In fact, dyads 3 and 1 already had extensive technological knowledge and personal contact with similar tools. In the case of dyad 3, the PWD was a major consumer

of technology before his diagnosis and thus he had a lot of exposure to it, believed in his skills to use it and was very comfortable doing so. In the case of the first dyad, the biggest influence on the use of the Claris Companion, as described in the Technology Acceptance Model (Rose & Fogarty, 2006) was subjective norms. From the very beginning, the daughters were concerned about the rudimentary features of the Claris Companion as compared to a mainstream iPad. Even at the pretrial interview, it set the stage for how the tool was to be perceived and may have influenced its use by their mother.

For the other dyads, the anticipated use of the tool could also be explained through the Technology Acceptance Model. Interestingly, despite have previous technology discomfort, the participants were encouraged to use the tool because of the anticipated benefit identified by the caregivers. For instance, in the case of dyad 2, the PWD had previous discomfort with technology but was encouraged by her daughter (social norms) who saw the potential of the Claris Companion. In dyad 5, both the caregiver and the PWD were uncomfortable with the technology but were encouraged by their adult children to try it out. The PWD in Dyad 4 had also experienced discomfort with technology with cell phone use. After trying the tool during training, she gained some level of perceived self-efficacy to try the tool herself. It appears clear that the role of the caregivers in supporting the PWD's use of the Claris Companion was extremely important, with the exception of Dyad 3 where the PWD was already an avid user of technology.

8.3 Post-trial Use of the Claris Companion

The post-trial results were very interesting and at first might appear illogical. While participants made several comments regarding the difficulty of use of some of the features of the device, many found many of these same features useful in practice. Karapanos, Zimmerman, Forlizzi and Martens (2009) looked at the usability and usefulness of iPhones and concluded that if users saw the relevance or usefulness of a tool, they were more likely to invest the time to learn how to use the device, despite the perceived difficulty associated with its use. In other words, dyads might have seen the potential contribution of the Claris Companion in reducing burden and improving connections with family and might have looked beyond its technical difficulties. In fact, the results did show that participants considered the device to be useful in nurturing family relationships, and leisure activities through web browsing, despite the technical issues that were expressed.

The first challenge expressed in the literature review (refer to section 1.2.1.) was that PWD have difficulty in managing their own medication regiment (Campbell, Boustani, Skopelja, Gao, Unverzagt, & Murray, 2012; Kaastalainen et al., 2011; Gillepsie, Mullan, & Harrison, 2013). Surprisingly, reminders were among the least used functions of all the Claris Companion functions. When investigating further into this matter, it was discovered that the reason for this is that the PWD and their caregiver had already found strategies to overcome this challenge and had integrated it into their daily routine. Since each dyad would only have the device for a period of six weeks, the caregiver did not want to disrupt their daily routine by introducing something new and potentially confusing to the PWD. Moreover, although the third dyad used the medication

reminders function, the caregiver pointed out that it does not ensure that the PWD did in fact take their medication.

The second challenge expressed in the literature was the loss of the PWD's identity (Genoe & Dupuis, 2012). The PWD in the fourth dyad could really relate to this challenge. She used to be very social, positive and funny; however, as she expressed a concern over gradually losing a variety of these skills to dementia, thereby becoming very withdrawn and pessimistic. She found that the device helped her feel like her old self again. Despite her oral communication difficulties, she was able to communicate electronically. Thus, she was able to become social again and regain contact with her friends. Therefore, she was able to avoid the otherwise cyclical process of identity loss associated with dementia (Genoe, 2010) by regaining some of her previous social roles.

The third challenge was the loss of the sense of social connectedness (Alzheimer Society of England, 2013). There were many factors that came into play including deteriorating social skills (Rousseaux, Seve, Vallet, Pasquier, & Mackowiak-Cordoliani, 2010) and living away from family members and friends (Moyle, Kellett, Ballantyne, & Gracia, 2011). The PWD in dyads three and four both had oral communication difficulties. They both found that the device helped them overcome those communication difficulties by giving them a different medium. The fourth and fifth dyads had children living abroad. They both found that the device helped them feel more involved in the lives of their children and grandchildren because they received pictures and videos from them on a daily basis.

According to the actual use of the Claris Companion based on the logs, communication, and particularly the messaging function, was used by all dyads. The

caregivers enjoyed the messaging function because it was so much more convenient to just email or text the PWD directly instead of calling them.

A closer look at the individual dyads reveals some explanation of the results. In Dyad 1, the mother had not been very motivated to use the device in terms of leisure and reminders. The daughters' preconceived notions about the device could have influenced its use. The daughters did not invest in the managerial functions of the Claris Companion, having a poor view of its functionality. This might have limited their mother's ability to have enough personal contact with the device, especially when it came to leisure activities such as web browsing.

In the case of the second dyad, the PWD commented that she did not have any friends her age that use technology, which made the facilitated communication aspect of it less attractive to her. She also did not believe that she could use the Claris Companion. However, in this case, her daughter sent her daily reminders to encourage her to send messages which increased her use of this function. The PWD felt especially confident in her use of the device for physical activity. As illustrated in the Technology Acceptance Model, her self-efficacy in this domain and motivation to keep physically active, encouraged her use of the Claris Companion for this purpose.

The important role played by caregivers is also evident with the third dyad. Contrary to the first dyad, his wife invested her time into the managerial functions of the Claris Companion and really tried to take advantage of everything it had to offer. As a support to her husband's high level of facility with technology, she overcame her own discomfort with technology, leading to her playing an important facilitating role.

In the case of the fourth dyad, the PWD was originally uncomfortable with the idea of using technology. However, she believed that the Claris Companion was simple enough that she could use it. Therefore, throughout the six-week trial she used it on a daily basis and became increasingly comfortable with it. In contrast to the second dyad, she had many friends that used technology so she was able to communicate with them using the Claris Companion.

In the case of the fifth dyad, both members of the dyad were not very comfortable with technology. However, their adult children, who live abroad and thus were not able to directly participate in the study generated enough motivation to use the Claris Companion, despite the reticence associated with its usability. Since the caregiver was uncomfortable using technology, she did not really invest in the managerial function of the Claris Companion. Thus, it limited the PWD ability to be able to interact with the device and take full advantage of everything it has to offer. Also, the PWD did not believe that he could use the Claris Companion, and his wife did not encourage him. Thus, this is the dyad that took the least advantage of what the Claris Companion has to offer. The lack of a supportive caregiver to encourage the PWD resulted in more reduced use of the tool.

8.5 Technology Acceptance Model (TAM)

For the most part, the technology acceptance model was very helpful in explaining the process by which the participants adopted or did not adopt the Claris Companion. This study brought to light a few changes that could contribute to a next version of the TAM. Part of this study was to question whether PWD could indeed use a technological device such as the Claris Companion. Despite the functional limitations

experienced by individuals with mild to moderate dementia, and despite the stigma associated with these limitations, PWD were indeed able to use many of the functions. Hence, stigma can be perceived as a determinant of subjective norms. For instance, many people might think that PWD cannot use a device such as the Claris Companion because it will be too complicated for them. However, caregivers saw potential in the usability and usefulness of the device and thus agreed to be part of the study.

Despite being able to use the tool, some functions, such as medication reminders, were not perceived to be useful. One concern was that while the tool reminded them to take the medication, the medication needed to be located close to the device in order for this function to be useful. The TAM model does not sufficiently provide for an explanation of the role of these environmental factors in the adoption of new behaviours related to technology. Environmental factors should be incorporated into the TAM as a determinant of behavioral intention.

8.6 Limitations

This study has a number of limitations. Firstly, the interviews were conducted on a small sample of participants. However, the sample size is appropriate for a pilot study and is comparable to other usability pilot studies such as the one by Meiland et al. (2012). Secondly, the pre-trial interviews conducted on dyads 1 and 2 did not generate sufficient information regarding the real needs of the dyads. In order to overcome this limitation, a needs assessment was added as part of the protocol for the next three dyads but had been missing for the first two dyads. Thirdly, the results and conclusions of the study should have been verified with the participants of the study. While contact was made with the participants to conduct a focus group regarding the relevance of the data, no participants

were interested in participating, seeing this step as a burden to their increasingly demanding schedules and responsibilities. Lastly, because of the role of the caregiver and the lack of knowledge of the current participants with technology, it might have been desirable to have a longer trial period.

8.7 Lessons Learned

This pilot study led to a better understanding of the factors to include in a larger study. Throughout this pilot study, the procedures were streamlined. Some of the issues that came up were the reliability of the internet and what to do in the case of absence due to hospitalization. For instance, the PWD in dyad 3 attended a day program with no Wi-Fi access. Thus, while he was there, he was unable to use the device. Another dyad participated in the needs assessment and pre-trial interview but the PWD was hospitalized for an extended period of time. While the caregiver had wished to stay in the study, they had to withdraw.

Since the Claris Companion has so many functions, not all participants were able to use them all throughout the six-week trial. The study could have focused on a pre-determined subset of the functions, to ensure that all participants had used these functions and thus can given feedback accordingly.

Since the Claris Companion was never tested on people with dementia, other studies (e.g. Meiland et al,, 2012) were used to estimate the MMSE range that should be able to use a device such as the Claris Companion. The PWD in dyad 2 and 5 had the lowest MMSE scores. They were less able to benefit from the Claris Companion. Thus, future studies should focus on individuals with mild dementia (MMSE score of 20-25). If PWD learn to use the Claris Companion at the early stages of dementia, there is potential

for them to integrate it into their daily routine and thus might potentially still be able to use it in the moderate stages.

8.8 Future Research

This study demonstrated how a touchscreen assistive device such as the Claris Companion could help PWD regain their sense of identity and feel more socially connected to their friends and family. Furthermore, this study also demonstrated how a device such as the Claris Companion gives peace of mind to caregivers who may wish to have some level of independence from the PWD home alone while they are at work or running errands.

Future research should continue exploring these findings but with a larger sample size to ensure that the results are more generalizable. Moreover, future studies should ensure that each dyad uses the device for a longer period of time, in order to document the change in device use over time.

There are many other touchscreen tablets available on the market today. Now that the usability of the Claris Companion was preliminarily tested with PWD, another avenue of investigation could include a randomized control trial comparing it to other touchscreen devices.

Some of the feedback that was received is specific to the features and limitations of the Claris Companion. Future studies could explore other similar devices or some changes could be made to the current Claris Companion to facilitate its usage. Such upgrades might include more functions that facilitate the development of interpersonal relationships. Suggestions could be the inclusion of common events to do with spouses and friends, a re-adjustment of the event reminders that resemble a paper calendar. The “Check-in” and

"Call-me" function may prove to be more useful for individuals with more advanced dementia and remains to be tested in future studies.

The incoming generation of seniors may include individuals who had more exposure to technology and ICT devices throughout their lives. It will be beneficial to compare the results associated with this cohort compared to seniors who did not have as much exposure to technology. In this study, the PWD in the third dyad had a lot of exposure to technology. Thus, he was able to show the potential of such devices for the incoming generation of seniors.

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Figures

Figure A. Technology Acceptance Model (TAM)

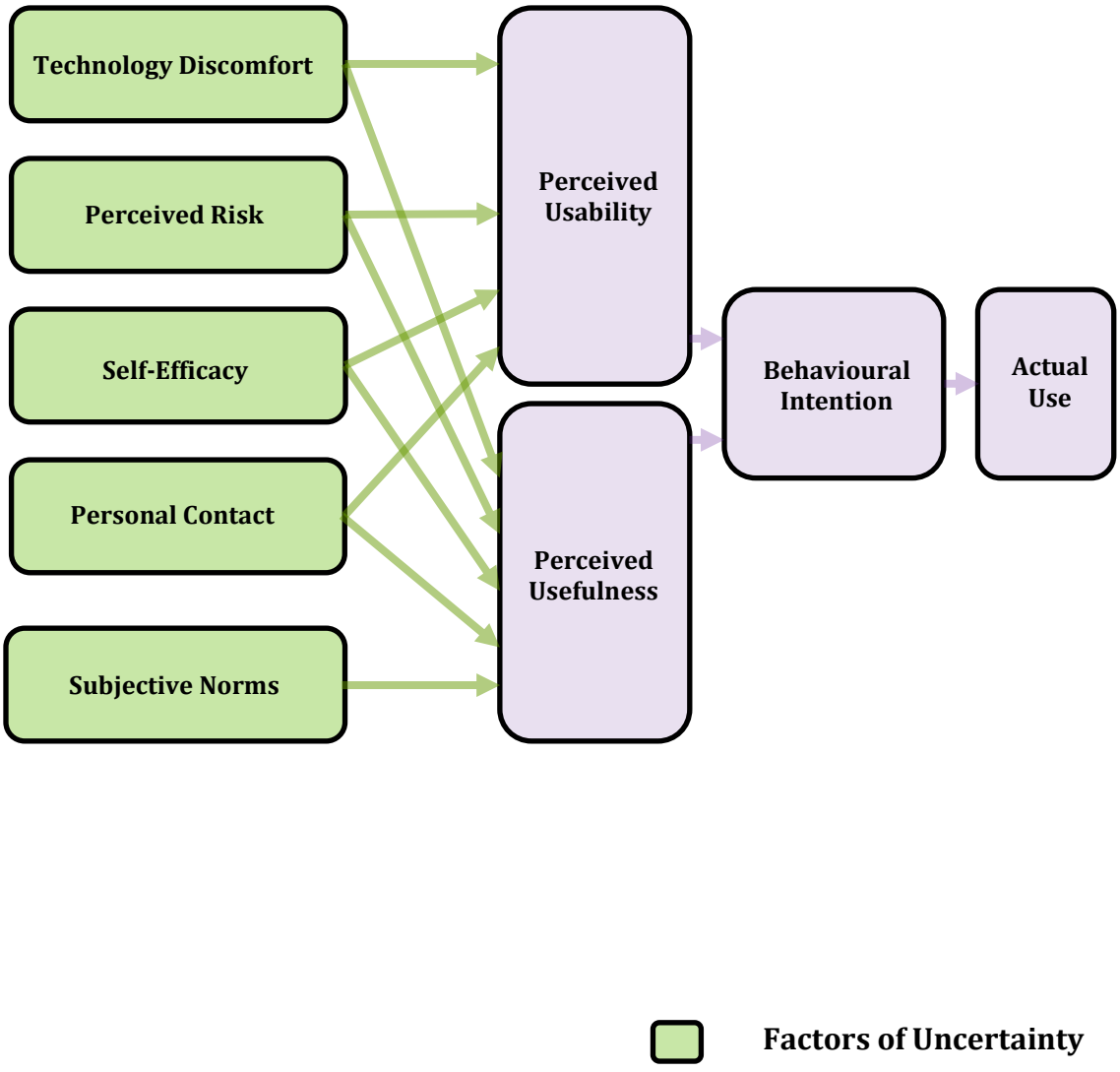


Figure B. Study procedures including participant recruitment

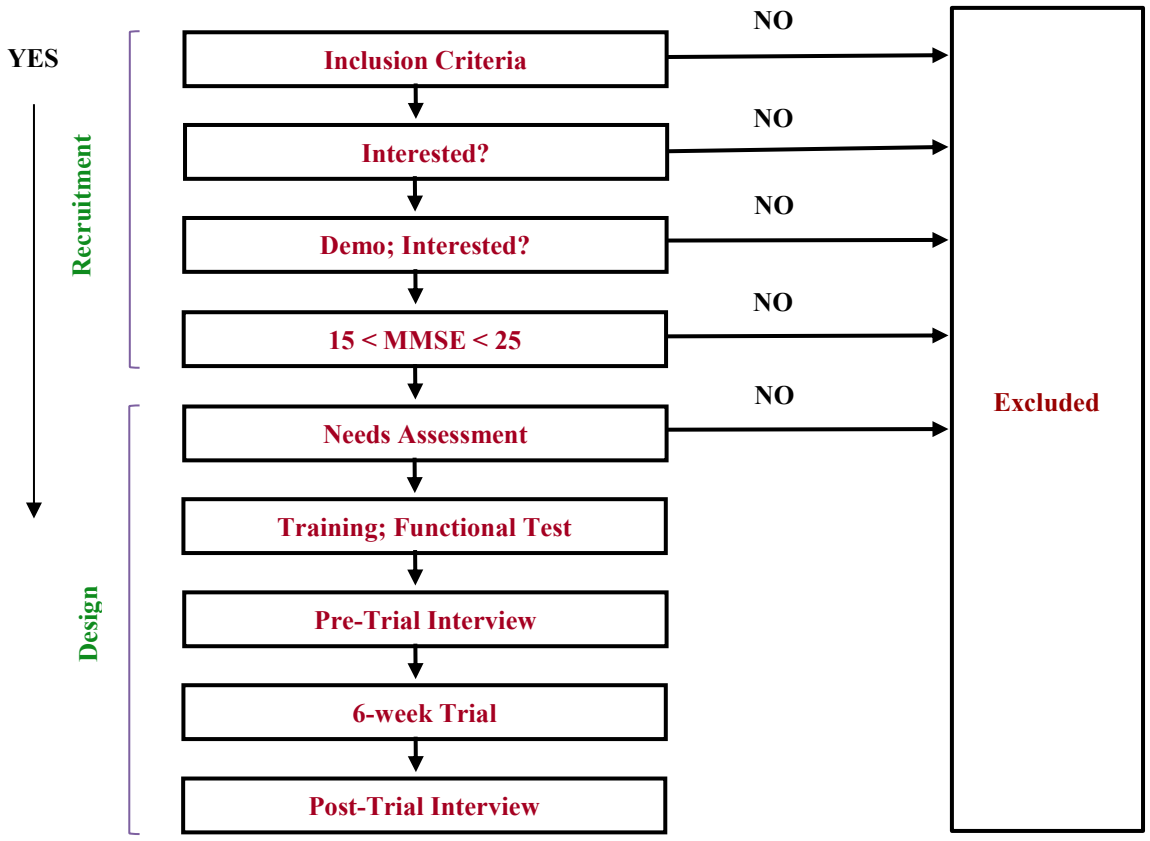


Figure C. The Disability Creation Process Model (DCP)

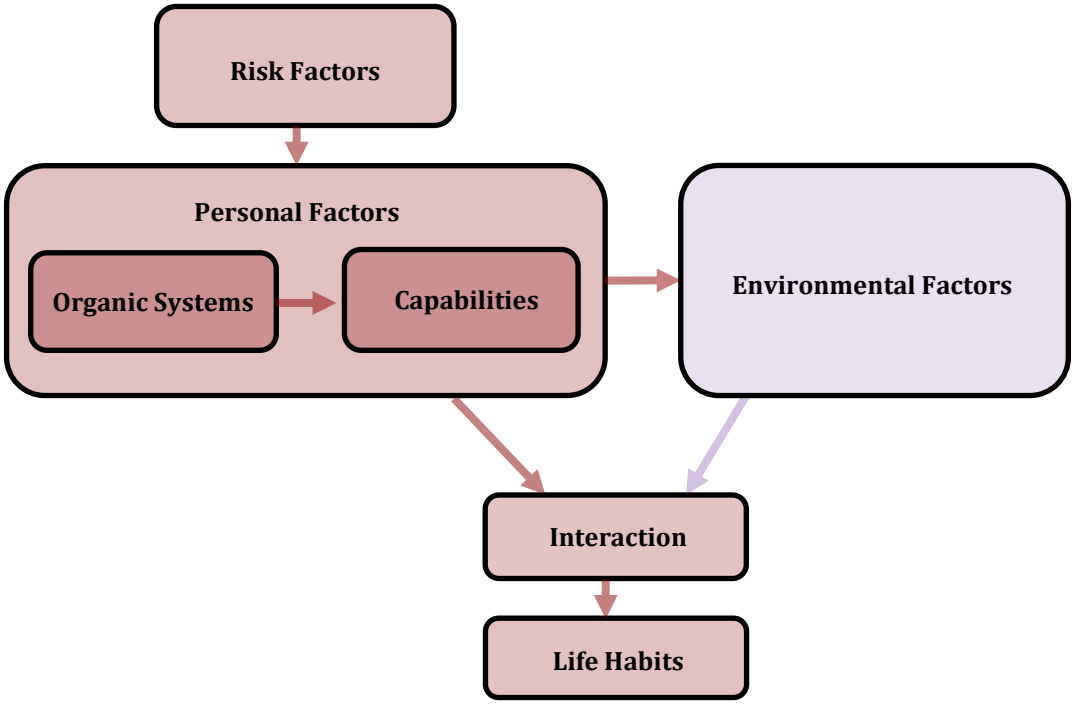
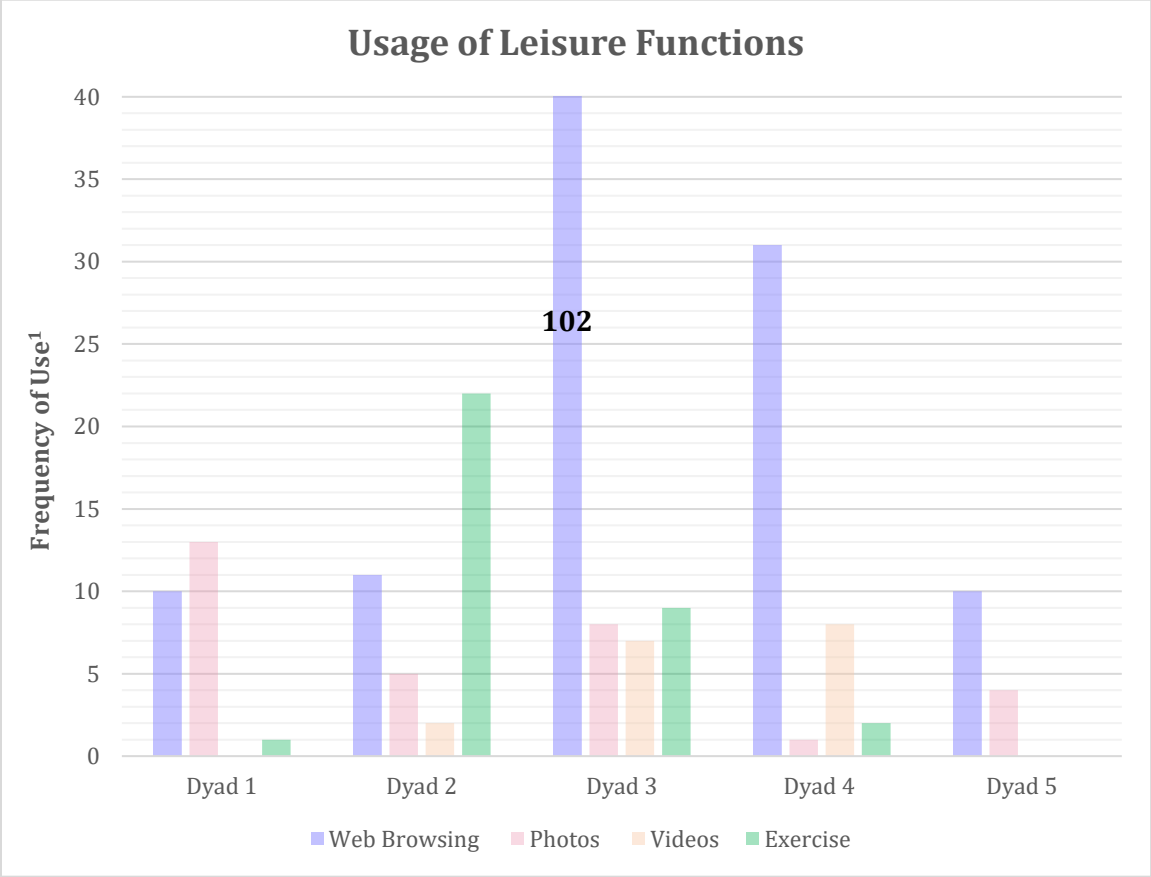
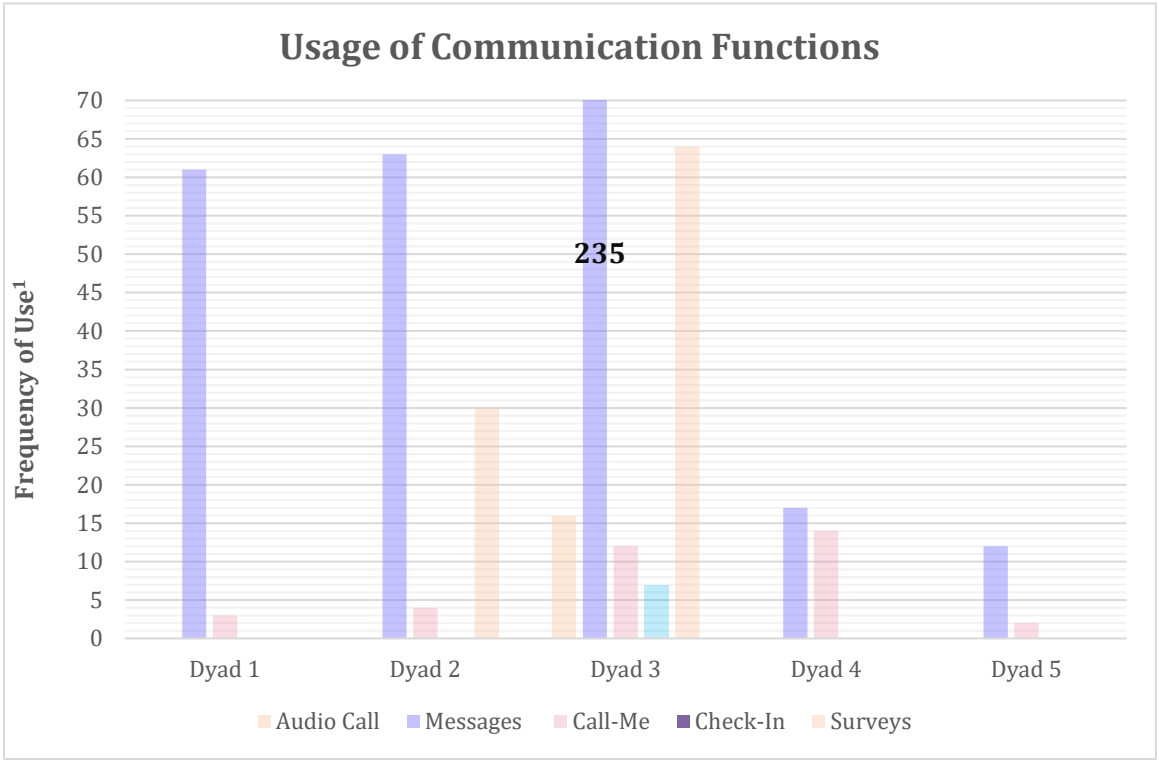


Figure D. Frequency of use of leisure functions for each dyad



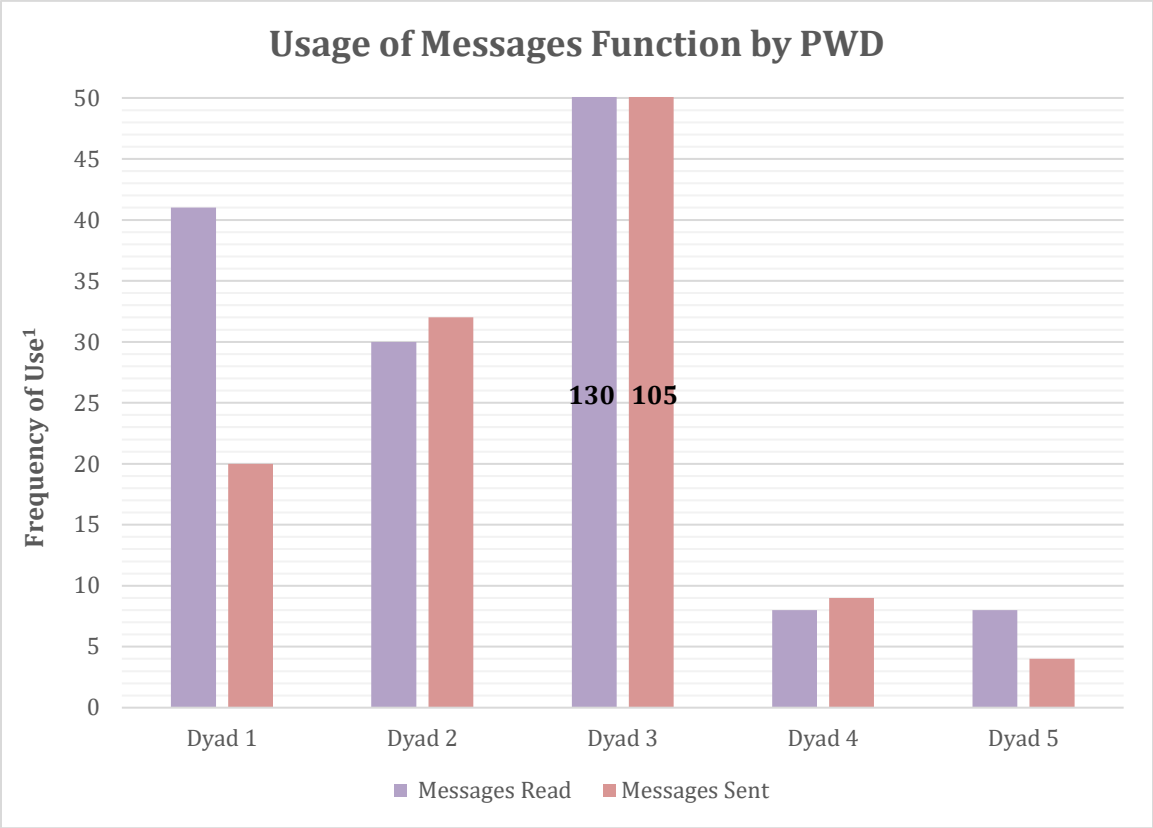
1. Frequency of use is the number of times that each dyad has used a given function throughout the six-week trial.

Figure E. Frequency of use of communication functions by each dyad



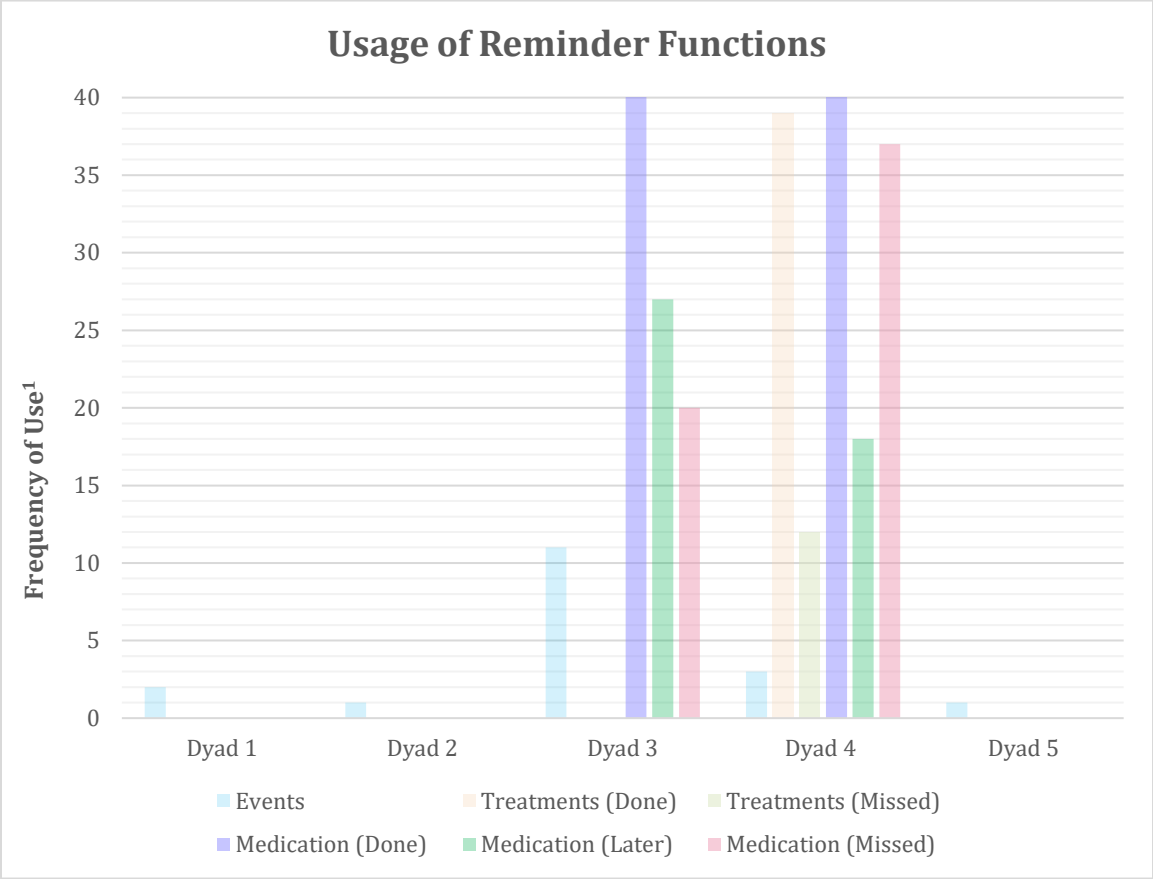
1. Frequency of use is the number of times that each dyad has used a given function throughout the six-week trial.

Figure F. Frequency of use of email/text messaging function by each PWD



1. Frequency of use is the number of times that each dyad has used a given function throughout the six-week trial.

Figure G. Frequency of use of reminder functions for each dyad



1. Frequency of use is the number of times that each dyad has used a given function throughout the six-week trial.

2. Done means that the PWD or their caregiver has pressed the "Done" button when prompted with a treatment reminder

3. Later means that the PWD or their caregiver has pressed the "Later" button when prompted with a medication reminder. Thus, he/she will be prompted again with the same reminder in thirty minutes.

4. Missed means that the PWD or their caregiver has not responded to the treatment or medication notification.

Tables

Table 1. Description of Dyads

Dyad Number	PWD Gender	Primary CG	Secondary CG	MMSE Score
1	Female	Daughter	Daughter	23/30
2	Female	Daughter	Husband	17/30
3	Male	Wife	N/A	25/30
4	Female	Husband	Formal CG	24/30
5	Male	Wife	N/A	16/30

Table 2. Hierarchical table of codes

WHO	FEATURE	USABILITY	USEFULNESS	IMPACT/NEED	ACCOMODATION
CG	Communication[1]	Usable	Useful	Activities[1]	Accessibility
Proxy	Alerts	Not Usable	Not Useful	Appliance Use	Community Services
PWD	Audio/Video Call			Driving	Spouse's Help
	Call-Me			Employment	
	Check-In			Grocery Shop	
	Messages			House Chores	
	Q&A			Med Admin	
	Wellness Survey			Rec Activities	
	Leisure[1]			Fitness[1]	
	Exercise Videos			Mental	
	Photos			Physical	
	Videos			Sleep	
	Web Browsing			Spirituality	
	Reminders[1]			Interpersonal Relationships[1]	
	Events			CG Role	
	Medication			Communication	
	User Interface[1]			Family Relationship	
	Buttons			Friendly Relationships	
	Manger			Marital Relationships	
	Screen Size			Nutrition[1]	
	Sound			Eating	
				Hunger	
				Meal Prep	
				Financial Responsibilities[1]	
				Financial Responsibilities	

1. Text in red refers to superordinate categories. They embody the categories below.

Table 3. Operational Definition of Codes

Accommodation[1]	
Accessibility	This refers to how the physical environment can be ergonomically improved to facilitate physical movement. This study looked into the impact of dementia on accessibility and if the tool could/did help overcome any of the difficulties that were encountered.
Community Services	This refers to the organizations and services related to activities which can provide people and their family with various forms of resources to face life's difficulties such as providing the time to rest and by helping out, baby-sitting, psychological support, residential support, domestic assistance, etc. This study looked into the impact of dementia on the use of social assistance and if the tool could/did help overcome any of the difficulties that were encountered.
Spouse's Help	This refers to how the PWD's spouse helps facilitate the PWD's ability to accomplish various tasks (e.g. driving around PWD, taking over household chores and finances, etc.). This study looked into the impact of dementia on the spouse's help and if the tool could/did help overcome any of the difficulties that were encountered.
Activities[1]	
Appliance and Computer Use	This refers to the impact that dementia or the Claris Companion has on the ability to use household appliances such as toasters, coffee makers, microwaves and computers. This study looked into the impact of dementia on appliance and computer use and if the tool could/did help overcome any of the difficulties that were encountered.
Driving	This refers to the impact that dementia has on the ability to drive. This study looked into the impact of dementia on driving and if the tool could/did help overcome any of the difficulties that were encountered.
Employment	This refers to the impact that dementia has on the habits related to one's primary occupation, usually a paid occupation. This includes guidance (the habits related to the choice of a career, career counseling and redefining a career), job search (the habits related to seeking and finding employment), paid occupation (the habits related to performing a paid occupation), and unpaid occupation (habits related to performing a primary occupation that is unpaid). This study looked into the impact of dementia on employment and if the tool could/did help overcome any of the difficulties that were encountered.

Grocery Shopping	This refers to the impact that dementia has on the PWD's ability to travel to a grocery store, purchase the right items and return back home. This study looked into the impact of dementia on grocery shopping and if the tool could/did help overcome any of the difficulties that were encountered.
House Chores	This refers to the impact that dementia has on the PWD's ability to accomplish chores in order to maintain the inside and outside of the house. This study looked into the impact of dementia on house chores and if the tool could/did help overcome any of the difficulties that were encountered.
Medication Administration	This refers to the impact that dementia has on the habits related to prevention and to the maintenance and recovery of personal health, such as taking medication, using bandages and using therapeutic equipment. This category does not include habits related to physical fitness or to health care services included in community. This study looked into the impact of dementia on medication administration and if the tool could/did help overcome any of the difficulties that were encountered.
Recreational and Community Activities	This refers to the impact of dementia on the habits related to the consumption of community good and services (e.g. shopping centers, community centers, religious/spiritual practices) and habits related to the individual's free time and recreation (e.g. sports, arts, culture hobbies/events).
Communication Functions[1]	
Alerts	The Claris Companion can automatically generate alerts sent to your cell phone or email if anything is out of the ordinary such as missed medications, treatments, or check-ins. Alerts can be tailored for specific family members or home care workers to follow-up before an adverse event occurs. Alerts are an easy way to keep track of your loved one and make sure that they are ok. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their CG.
Audio/Video Call	Speak face-to-face with your loved-one using Claris Companion video chat. Unlike other popular video chat applications, Claris Companion is private, secure and easy to use. Family can use any device to call including a phone application. Because your loved-one's Claris Companion is always on, they will always be alerted to an incoming call and only need to touch the "Answer" button. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.

Call-Me	Many seniors recognize that loved ones lead busy lives and don't want to disturb them even though they wished "you'd call more often". With a touch of the "Call Me" button an email or text message can be sent to loved ones asking them to call when they get a chance. As a result, isolated seniors can reach out to family and friends without feeling like they're being intrusive. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Check-In	In the morning, seniors can press the "check-in" button to send an email or text message to loves ones letting them know they're okay. If the check-in button is not pressed, after a configurable amount of time an alert will be generated and sent to family or caregivers notifying them that the check-in was missed. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Email and Text Messages	Send emails and text messages directly to Claris Companion (a private email address and text message number is provided). Seniors are notified immediately and messages appear in large easy-to-read text. They can also reply or write new messages using the on-screen keyboard. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Q&A	Without intruding, get answers to simple questions by scheduling surveys. With the touch of one button, your loved one can respond to any question you configure. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Wellness Survey	Daily wellness surveys can be scheduled that kindly ask the senior how they are feeling. With the touch of a button (better\same\worse), wellness trends can be established over time and alerts can bet sent to family members and caregivers. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Financial Responsibilities[1]	
Financial Responsibilities	This refers to the impact that dementia has on the habits related to preparing and following a budget, and to debts and other financial obligations. This study looked into the impact of dementia on the financial responsibilities and if the tool could/did help overcome any of the difficulties that were encountered.

Fitness[1]	
Mental Fitness	This refers to the impact that dementia has the habits related to the maintenance, improvement, and recovery of mental fitness, such as mental relaxation, meditation, intellectual stimulation, etc. This study looked into the impact of dementia on mental fitness and if the tool could/did help overcome any of the difficulties that were encountered.
Physical Fitness	This refers to the impact that dementia has on the habits related to the maintenance, improvements and recovery of physical fitness, such as physical exercises and relaxation, etc. This does not include habits related to health care, hygiene or sports or games.
Sleep	This refers to the impact of dementia on the habits related to sleep, such as using accessories to sleep. This category does not include habits related to personal care.
Spirituality	This refers to the impact of dementia on the PWD and their caregiver on their ability to participate in an organized religion or in any meditation-based practices.
Interpersonal Relationships[1]	
Caregiving Role	This refers to the impact that dementia has on the caregiver's need to change from a marital role to a caregiving one. This study looked into the impact of dementia on the caregiving role and if the tool could/did help overcome any of the difficulties that were encountered.
Communication	This refers to the impact that dementia has on the habits that enable a person to convey messages and to receive messages from others and from society. This includes oral and sign communication (e.g. spoken and non-verbal), written communication (e.g. written messages, newspapers, books, etc.), telecommunication (radio, television, computer/email, etc.), and signs (public building signs, road signs, alarm system, buzzers, etc.). This study looked into the impact of dementia on the communication and if the tool could/did help overcome any of the difficulties that were encountered.
Family Relationships	This refers to the impact that dementia has on the ability to interact with non-spousal family members. This study looked into the impact of dementia on family relationships and if the tool could/did help overcome any of the difficulties that were encountered.
Friendly Relationships	This refers to the impact that dementia has on the ability to interact with friends in the workplace and larger community. This includes acquaintances and work colleagues. This study looked into the impact of

	dementia on friendly relationships and if the tool could/did help overcome any of the difficulties that were encountered.
Marital Relationships	This refers to the impact that dementia has on the PWD's ability to interact with their spouse. This study looked into the impact of dementia on the marital relationship and if the tool could/did help overcome any of the difficulties that were encountered.
Leisure Functions[1]	
Exercise Videos	Daily exercise has been proven to improve the physical and mental well-being of seniors. Claris Companion offers one touch exercise videos specifically developed for seniors at home. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Photos	Email (or upload) digital photos to your loved one's Claris Companion from anywhere. New photos are automatically displayed on the screen and are stored in their personal photo album to enjoy at any time. When not in use, the Claris companion can be set to display photos in slideshow mode, just like a digital picture frame. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Videos	Videos can be a powerful way for you to engage your loved one socially as well as provide valuable care information. Anyone can upload videos of any format to the Claris Companion from anywhere. New videos are automatically displayed on the screen and are stored in their personal video album to enjoy anytime. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Web Browsing	Remotely configure access to any website so your loved one can get information on local services and keep up-to-date with news from around the world. Each website is accessible on Claris Companion by touching a large button that you can name (e.g. weather, shopping, banking, etc.). This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Nutrition[1]	
Eating	This refers to the impact of dementia on the habits related to eating of meals, such as the use of drinking and eating utensils (e.g. plates, glasses, knives and forks) and general table manner. This study looked into the impact of dementia on eating and if the tool could/did help overcome any of the difficulties that were encountered.

Hunger	The capability to feel the need to eat. This study looked into the impact of dementia on hunger and if the tool could/did help overcome any of the difficulties that were encountered.
Meal Preparation	This refers to the impact that dementia has on the habits related to the preparation of meals, such as the storing and processing of foods, and involving the use of the appropriate utensils (e.g. refrigerator, pots and pans, food processor, etc.). This study looked into the impact of dementia on food preparation and if the tool could/did help overcome any of the difficulties that were encountered.
Reminders[1]	
Event Reminders	Schedule calendar event notification remotely. Claris Companion will automatically alert your loved one to important activities such as appointments, visits, social engagements, birthdays, etc. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Medication Reminders	Medication compliance is critical to helping keep seniors safe at home and out of the hospital. Claris Companion can be configured to remind seniors when to take their medications or to perform other health care related treatments such as glucose testing. Alerts can be sent to family and care providers if reminders are missed. This study looked into whether this function will be/was easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
User Interface[1]	
Buttons	This refers to how the size and number of buttons on the Claris Companion's screen will make/made it easy or difficult to use and whether or not it will meet/met the needs of the PWD and their CG.
Claris Companion Manager	This refers to how the Claris Companion's managerial functions will be/were easy to set-up by caregiver including setting-up and personalizing the device. Managers can personalize the device by choosing which functions to activate according to the user's needs. They are also able to set-up the reminders and add contacts for the user to interact with using the device. This study looked into whether these functions will be/were easy or difficult to use/set-up and whether or not it will meet/met the needs of the PWD and their caregiver.
Screen Size	This refers to whether or not the screen will be/was adequately sized for PWD.

Sound	This refers to whether the Claris Companion's sound will be/was loud enough for PWD to hear.
Text Size	This refers to whether the Claris Companion's on screen text will be/was adequately sized for PWD.

1. Text in red refers to superordinate categories. They embody the categories below.

Table 4. Coding frequency table of needs assessment transcripts

Code	Impact		Overall	CG	Proxy	PWD
Accommodation[1]						
Accommodation	*Yes*	*Sources*[2]	3	3	2	2
		References[3]	34	6	19	9
	No	*Sources*[2]	3	1	1	1
		References[3]	4	1		3
Accessibility	*Yes*	*Sources*[2]	2		2	
		References[3]	2		2	
	No	*Sources*[2]				
		References[3]				
Community Services	*Yes*	*Sources*[2]	3	3	2	1
		References[3]	14	5	4	5
	No	*Sources*[2]	1	1		
		References[3]	1	1		
Spouse's Help	*Yes*	*Sources*[2]	3	1	3	1
		References[3]	18	1	13	4
	No	*Sources*[2]	1			1
		References[3]	3			3
Activities[1]						
Activities[1]	*Yes*	*Sources*[2]	3	3	3	2
		References[3]	41	9	23	9
	No	*Sources*[2]	2	2	2	2
		References[3]	12	3	2	7
Appliance & Computer Use	*Yes*	*Sources*[2]	3		3	
		References[3]	4		4	
	No	*Sources*[2]	1		1	1
		References[3]	2		1	1
Driving	*Yes*	*Sources*[2]	3	2	3	2
		References[3]	8	2	4	2
	No	*Sources*[2]				
		References[3]				

Code	Impact		Overall	CG	Proxy	PWD
Employment	*Yes*	*Sources*[2]	3	2	2	2
		References[3]	7	2	2	3
	No	*Sources*[2]	2	1		1
		References[3]	2	1		1
Grocery Shopping	*Yes*	*Sources*[2]	2		2	
		References[3]	2		2	
	No	*Sources*[2]				
		References[3]				
House Chores	*Yes*	*Sources*[2]	3	1	2	
		References[3]	5	1	4	
	No	*Sources*[2]	2	1	1	1
		References[3]	4	1	1	2
Medication Administration	*Yes*	*Sources*[2]	2		2	
		References[3]	2		2	
	No	*Sources*[2]				
		References[3]				
Recreational & Community Activities	*Yes*	*Sources*[2]	3	2	2	1
		References[3]	13	4	5	4
	No	*Sources*[2]	2	1		2
		References[3]	4	1		3
Fitness[1]						
Fitness	*Yes*	*Sources*[2]	3	3	3	3
		References[3]	22	10	8	4
	No	*Sources*[2]	4	2	2	1
		References[3]	8	3	2	3
Mental Fitness	*Yes*	*Sources*[2]	3	3	3	1
		References[3]	14	9	3	2
	No	*Sources*[2]	1	1		1
		References[3]	2	1		1
Physical Fitness	*Yes*	*Sources*[2]	3		2	1
		References[3]	5		4	1
	No	*Sources*[2]	1	2		
		References[3]	2	2		

Code	Impact		Overall	CG	Proxy	PWD
Sleep	*Yes*	*References*[3]	1	1		1
		Sources[2]	2	1		1
	No	*References*[3]	1		2	1
		Sources[2]	3		2	1
Spirituality	*Yes*	*References*[3]	1		1	
		Sources[2]	1		1	
	No	*References*[3]	1			1
		References[3]	1			1
Interpersonal Relationships[1]						
Interpersonal Relationships	*Yes*	*Sources*[2]	3	2	3	2
		References[3]	32	5	15	12
	No	*Sources*[2]	1			1
		References[3]	6			6
CG Role	*Yes*	*Sources*[2]	2	2		
		References[3]	2	2		
	No	*Sources*[2]				
		References[3]				
Communication	*Yes*	*Sources*[2]	3	1	2	2
		References[3]	9	1	5	3
	No	*Sources*[2]	2			1
		References[3]	3			3
Family Relationships	*Yes*	*Sources*[2]	3	1	2	2
		References[3]	7	1	4	2
	No	*Sources*[2]	1			1
		References[3]	2			2
Friendly Relationships	*Yes*	*Sources*[2]	3		3	
		References[3]	4		4	
	No	*Sources*[2]				
		References[3]				
Marital Relationship	*Yes*	*Sources*[2]	3	1	2	1
		References[3]	10	1	2	7
	No	*Sources*[2]	1			1
		References[3]	1			1

Code	Impact		Overall	CG	Proxy	PWD
Nutrition[1]						
Nutrition	*Yes*	*Sources*[2]	3		3	1
		References[3]	5		4	1
	No	*Sources*[2]	3		0	3
		References[3]	7		4	3
Eating	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3		2	2
		References[3]	4		2	2
Hunger	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Meal Prep	*Yes*	*Sources*[2]	4		3	1
		References[3]	3		4	1
	No	*Sources*[2]	2		1	1
		References[3]	2		1	1
Financial Responsibilities[1]						
Financial Responsibilities	*Yes*	*Sources*[2]	3		3	1
		References[3]	4		3	1
	No	*Sources*[2]	3		2	1
		References[3]	3		2	1

1. Text in red refers to superordinate categories. They embody the categories below.
2. There was a possibility of a maximum of 6 sources (3 dyads x 2 interviews): interviews were separate for CG and PWD giving a total of 6 sources. Proxy data was embedded in the CG interview.
3. References refer to the number of times a piece of text was coded under this theme.

Table 5. Coding frequency table of usability for pre-interview transcripts

Code	Usable		Overall	CG	Proxy	PWD
Communication Functions[1]						
Communication Functions	*Yes*	*Sources*[2]	2	1	1	
		References[3]	2	1	1	
	No	*Sources*[2]	2	1	2	
		References[3]	4	2	2	
Audio/Video Calling	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2	1	2	
		References[3]	3	1	2	
Call-Me	*Yes*	*Sources*[2]	1	1	1	
		References[3]	2	1	1	
	No	*Sources*[2]				
		References[3]				
Messages	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1	1		
		References[3]	1	1		
Leisure Functions[1]						
Leisure Functions	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		2	
		References[3]	2		2	
Web Browsing	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		2	
		References[3]	2		2	
Reminders[1]						
Event Reminders	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1	1		
		References[3]	1	1		

Code	Usable		Overall	CG	Proxy	PWD
User Interface[1]						
User Interface	*Yes*	*Sources*[2]	4		1	3
		References[3]	9		1	9
	No	*Sources*[2]	2		1	1
		References[3]	7	3	3	1
Buttons	*Yes*	*Sources*[2]	3		1	2
		References[3]	2		1	2
	No	*Sources*[2]				
		References[3]				
Claris Companion Manager	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1	1		
		References[3]	2	2		
Screen Size	*Yes*	*Sources*[2]	3			3
		References[3]	3			3
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Sound	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	1		2	
		References[3]	2		2	
Text Size	*Yes*	*Sources*[2]	3			3
		References[3]	3			3
	No	*Sources*[2]	1			1
		References[3]	1			1

1. Text in red refers to superordinate categories. They embody the categories below.
2. There was a possibility of a maximum of 5 sources (5 dyads): interviews for the CG and PWD were conducted together giving a total of 5 sources. Proxy data was embedded in the CG interview.
3. References refer to the number of times a piece of text was coded under this theme.

Table 6. Coding frequency table of usefulness for pre-interview transcripts

Code	Useful		Overall	CG	Proxy	PWD
Audio/Video Calling[1]						
Audio/Video Calling	*Yes*	*Sources*[2]	2		2	
		References[3]	6		2	4
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Family Relationships	*Yes*	*Sources*[2]	2		2	2
		References[3]	6		2	4
	No	*Sources*[2]				
		References[3]				
Friendly Relationships	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Call-Me[1]						
Call-Me	*Yes*	*Sources*[2]	3	1	1	3
		References[3]	5	1	1	4
	No	*Sources*[2]				
		References[3]				
Family Relationships	*Yes*	*Sources*[2]	1			1
		References[3]	2			2
	No	*Sources*[2]				
		References[3]				
Friendly Relationships	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Marital Relationship	*Yes*	*Sources*[2]	1	1		1
		References[3]	2	1		1
	No	*Sources*[2]				
		References[3]				

Code	Usable		Overall	CG	Proxy	PWD
Check-In[1]						
Check-In	*Yes*	*Sources*[2]	3	2	1	2
		References[3]	8	2	1	5
	No	*Sources*[2]	3	1	1	1
		References[3]	5	4		1
Communication	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3	3		
		References[3]	3	3		
Family	*Yes*	*Sources*[2]	1	1		1
		References[3]	2	1		1
	No	*Sources*[2]				
		References[3]				
Marital	*Yes*	*Sources*[2]	3	1	1	2
		References[3]	6	1	1	4
	No	*Sources*[2]	1	1		1
		References[3]	2	1		1
Email & Text Messages[1]						
Email & Text Messages	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	1			1
		References[3]	1			1
Communication	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	1			1
		References[3]	1			1
Event Reminders[1]						
Event Reminders	*Yes*	*Sources*[2]	3		1	3
		References[3]	9		2	7
	No	*Sources*[2]	2		1	1
		References[3]	2		1	1
Recreational and Community Activities	*Yes*	*Sources*[2]	3		1	3
		References[3]	9		2	7
	No	*Sources*[2]	2		1	1
		References[3]	2		1	1

Code	Usable		Overall	CG	Proxy	PWD
Exercise[1]						
Exercise	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	2		1	1
		References[3]	3		1	2
Physical Fitness	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	2		1	1
		References[3]	3		1	2
Medication Reminders[1]						
Medication Administration	*Yes*	*Sources*[2]	2		2	
		References[3]	2		2	
	No	*Sources*[2]	2		2	
		References[3]	2		2	
Photos[1]						
Photos	*Yes*	*Sources*[2]	3		2	2
		References[3]	8		2	6
	No	*Sources*[2]				
		References[3]				
Family Relationships	*Yes*	*Sources*[2]	3		2	1
		References[3]	5		2	3
	No	*Sources*[2]				
		References[3]				
Recreational & Community Activities	*Yes*	*Sources*[2]	1			1
		References[3]	3			3
	No	*Sources*[2]				
		References[3]				

Code	Usable		Overall	CG	Proxy	PWD
Q&A[1]						
Communication	*Yes*	*Sources*[2]	1		1	
		References[3]	1		1	
	No	*Sources*[2]	2		1	2
		References[3]	3		1	2
Videos[1]						
Family Relationships	*Yes*	*Sources*[2]	2		1	2
		References[3]	3		1	2
	No	*Sources*[2]				
		References[3]				
Web Browsing[1]						
Leisure	*Yes*	*Sources*[2]	1		1	1
		References[3]	2		1	1
	No	*Sources*[2]	1		1	
		References[3]	2		2	
Wellness Survey[1]						
Communication	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3		3	3
		References[3]	7		3	4

1. Text in red refers to superordinate categories. They embody the categories below.
2. There was a possibility of a maximum of 5 sources (5 dyads): interviews for the CG and PWD were conducted together giving a total of 5 sources. Proxy data was embedded in the CG interview.
3. References refer to the number of times a piece of text was coded under this theme.

Table 7. Coding frequency table of usability for post-interview transcripts

Code	Usable		Overall	CG	Proxy	PWD
Communication Functions[1]						
Communication Functions	*Yes*	*Sources*[2]	3	1	2	3
		References[3]	4		1	3
	No	*Sources*[2]	4	2	3	3
		References[3]	13	3	8	2
Audio/Video Calling	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3	1	1	1
		References[3]	5	2	2	1
Call-Me	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	2	1	1	
		References[3]	2	1	1	
Messages	*Yes*	*Sources*[2]	2		1	1
		References[3]	2		1	1
	No	*Sources*[2]	3		3	1
		References[3]	5		4	1
Q&A	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Wellness Survey	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	

Code	Usable		Overall	CG	Proxy	PWD
Leisure Functions[1]						
Leisure Functions	*Yes*	*Sources*[2]	3		2	1
		References[3]	5	2		3
	No	*Sources*[2]	4	1	3	
		References[3]	8	3	4	1
Exercise	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Photos	*Yes*	*Sources*[2]	3	2		1
		References[3]	3	2		1
	No	*Sources*[2]	1	1		
		References[3]	1	1		
Videos	*Yes*	*Sources*[2]	0	0		
		References[3]	0	0		
	No	*Sources*[2]	2	1		1
		References[3]	3	2		1
Web Browsing	*Yes*	*Sources*[2]	1			1
		References[3]	2			2
	No	*Sources*[2]	3		3	
		References[3]	3		3	
Reminders[1]						
Reminders	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	4	2	4	
		References[3]	14	3	11	
Event Reminders	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	4	2	4	
		References[3]	9	3	6	
Medication Reminders	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3		3	
		References[3]	5		5	

Code	Usable		Overall	CG	Proxy	PWD
User Interface[1]						
User Interface	*Yes*	*Sources*[2]	1			1
		References[3]	2			2
	No	*Sources*[2]	3	2	2	2
		References[3]	9	3	4	2
Buttons	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Claris Companion Manager	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2	2		
		References[3]	4	4		
Screen Size	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		2	
		References[3]	2		2	
Sound	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	3		3	
		References[3]	4		4	
Text Size	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				

1. Text in red refers to superordinate categories. They embody the categories below.
2. There was a possibility of a maximum of 5 sources (5 dyads): interviews for the CG and PWD were conducted together giving a total of 5 sources. Proxy data was embedded in the CG interview.
3. References refer to the number of times a piece of text was coded under this theme.

Table 8. Coding frequency table of usefulness for post-interview transcripts

Code	Usable		Overall	CG	Proxy	PWD
Audio/Video Calling[1]						
Audio/Video Calling	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	1			1
		References[3]	1			1
Family Relationships	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1			1
		References[3]	1			1
Friendly Relationships	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Call-Me[1]						
Call-Me	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		2	
		References[3]	2		2	
Communication	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Marital Relationship	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1		1	
		References[3]	1		1	
Check-In[1]						
Marital Relationship	*Yes*	*Sources*[2]	2		1	1
		References[3]	2		1	1
	No	*Sources*[2]				
		References[3]				

Code	Usable		Overall	CG	Proxy	PWD
Email & Text Message[1]						
Email & Text Message	*Yes*	*Sources*[2]	4		3	3
		References[3]	8		5	3
	No	*Sources*[2]				
		References[3]				
Communication	*Yes*	*Sources*[2]	3		2	3
		References[3]	5		2	3
	No	*Sources*[2]	1			1
		References[3]	1			1
Family	*Yes*	*Sources*[2]	3			3
		References[3]	3			3
	No	*Sources*[2]				
		References[3]				
Event Reminders[1]						
Event Reminders	*Yes*	*Sources*[2]	2		1	2
		References[3]	5		2	3
	No	*Sources*[2]	3		3	1
		References[3]	4		3	1
Recreational & Community Activities	*Yes*	*Sources*[2]	2		1	2
		References[3]	5		2	3
	No	*Sources*[2]				
		References[3]				
Exercise[1]						
Exercise	*Yes*	*Sources*[2]	2		1	2
		References[3]	5		2	3
	No	*Sources*[2]	1			1
		References[3]	1			1
Physical Activity	*Yes*	*Sources*[2]	2		1	2
		References[3]	5		2	3
	No	*Sources*[2]	1			1
		References[3]	1			1

Code	Usable		Overall	CG	Proxy	PWD
Medication Reminders[1]						
Medication Reminders	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	2	1		2
		References[3]	4	2		2
Medication Administration	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	2	1		2
		References[3]	4	2		2
Photos[1]						
Photos	*Yes*	*Sources*[2]	2			2
		References[3]	2			2
	No	*Sources*[2]				
		References[3]				
Family	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Mental Fitness	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Q&A[1]						
Q&A	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1			1
		References[3]	1			1
Communication	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	1			1
		References[3]	1			1

Code	Usable		Overall	CG	Proxy	PWD
Video[1]						
Video	*Yes*	*Sources*[2]	1			1
		References[3]	2			1
	No	*Sources*[2]				
		References[3]				
Recreational & Community Activities	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]				
		References[3]				
Web Browsing[1]						
Web Browsing	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	3		2	1
		References[3]	5		4	1
Recreational & Community Activities	*Yes*	*Sources*[2]	1			1
		References[3]	1			1
	No	*Sources*[2]	3		2	1
		References[3]	5		4	1
Wellness Survey[1]						
Wellness Survey	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		1	1
		References[3]	2		1	1
Communication	*Yes*	*Sources*[2]				
		References[3]				
	No	*Sources*[2]	2		1	1
		References[3]	2		1	1

1. Text in red refers to superordinate categories. They embody the categories below.
2. There was a possibility of a maximum of 5 sources (5 dyads): interviews for the CG and PWD were conducted together giving a total of 5 sources. Proxy data was embedded in the CG interview.
3. References refer to the number of times a piece of text was coded under this theme.

Appendix

Appendix A. Claris Companion. Copyright 2014 by Claris Companion Incorporation. Reproduced with permission.

Appendix B. Claris Companion senior-friendly design. Copyright 2014 by Claris Companion Incorporation. Reproduced with permission.

Appendix C. Claris Companion Website. Copyright 2014 by Claris Companion Incorporation. Reproduced with permission.

Appendix D. Needs assessment script

Person with Dementia

1. How have your memory problems affected your daily life?
2. What would you identify as your most pressing needs?

(*Let participant respond as he/she wishes – provided they focus on the question*) *Probing areas*:

Have your memory problems created any needs around:

a. Nutrition (diet, food preparation, meals)

b. Fitness (sleep, physical fitness, mental fitness)

c. Personal Care (hygiene, excretory hygiene, dressing, health care)

d. Communication (expression/reception of information)

e. Residence (housing, maintenance, household appliances)

f. Mobility (limited mobility, transportation)

g. Responsibility (financial and towards others)

h. Family relations (family, marital, parental, other relatives)

i. Interpersonal relations (sexual, affective, social)

j. Community (involvement in social/community/religious groups)

k. Education (school, university)

l. Employment (search, paid/unpaid)

m. Recreational and other habits (travelling, outdoor activities, culture)

Caregiver (about themselves)

1. How has caring for a person with memory problems affected your daily life?
2. What would you identify as your most pressing needs?

(*Let participant respond as he/she wishes – provided they focus on the question*) *Probing areas*:

Have the memory problems created any needs around:

a. Nutrition (diet, food preparation, meals)

b. Fitness (sleep, physical fitness, mental fitness)

c. Personal Care (hygiene, excretory hygiene, dressing, health care)

d. Communication (expression/reception of information)

e. Residence (housing, maintenance, household appliances)

f. Mobility (limited mobility, transportation)

g. Responsibility (financial and towards others)

h. Family relations (family, marital, parental, other relatives)

i. Interpersonal relations (sexual, affective, social)

j. Community (involvement in social/community/religious groups)

k. Education (school, university)

l. Employment (search, paid/unpaid)

m. Recreational and other habits (travelling, outdoor activities, culture)

Caregiver (about the person with dementia)

1. How have the memory problems affected your loved one's daily life?
2. What would you identify as his/her most pressing needs?

(*Let participant respond as he/she wishes – provided they focus on the question*) *Probing areas*:

Have the memory problems created any needs for your loved one around:

a. Nutrition (diet, food preparation, meals)

b. Fitness (sleep, physical fitness, mental fitness)

c. Personal Care (hygiene, excretory hygiene, dressing, health care)

d. Communication (expression/reception of information)

e. Residence (housing, maintenance, household appliances)

f. Mobility (limited mobility, transportation)

g. Responsibility (financial and towards others)

h. Family relations (family, marital, parental, other relatives)

i. Interpersonal relations (sexual, affective, social)

j. Community (involvement in social/community/religious groups)

k. Education (school, university)

l. Employment (search, paid/unpaid)

m. Recreational and other habits (travelling, outdoor activities, culture)

Appendix E. Pre-trial script

Usefulness:

1. Do you think that the Claris Companion might be useful? If so, how?
2. What features of the device do you expect to use the most/least? Why?
    a. Video calling, email and texts, photos, medication reminders, calendar reminders, web browsing, alerts, call me, Q&A, wellness survey, check-in, exercise video

Usability:

3. What do you expect will make the device easy/difficult for you to use? Why? (to person with dementia)
    a. Large buttons, amplified sounds, large screen text, always on, notifications project unto full screen, personalized
4. Do you expect your loved one to have difficulty with the use of this device? If so, how and why? (to caregiver)

Appendix F. Post-trial script

Usefulness:

1. To what extent has the device met your needs? How so? (to person with dementia)
    a. Questions will be specific to the needs mentioned in pre-trial interview.
    b. Repeat above question asking caregivers about the website and notifications instead of the device.
2. What can be done so that the device can further meet your needs? ? (to person with dementia)
    a. Features, appearance
    b. Repeat above question asking caregivers about the website and notifications instead of the device.
5. Other than meeting your needs, what are some added benefits by using the device that you did not expect? (to person with dementia)
    a. Did it help reduce your (caregiver) concerns regarding your love one? Why?
    b. Did it make you (PWD) feel more independent? Why?
    c. Repeat above question asking caregivers about the website and notifications instead of the device.
6. What features of the device and website did you find the most/least useful why? (to person with dementia)
    a. Video calling, email & texts, photos, Q&A, wellness survey, check-in, exercise video

b. Repeat above question asking caregivers about the website instead of the device.

7. What aspects of the device would you miss if you no longer had the device? Why? (to person with dementia)
    a. Video calling, email & texts, photos, medication reminders, calendar reminders, web browsing, alerts, call me, Q&A, wellness suvery, check-in, exercise video
    b. Repeat above question asking caregivers about the website and notifications instead of the device.

Usability:

8. Did you find the device easy to use? Why? (to person with dementia)
    a. Everything just appears, always on, large screen text, large buttons, amplified sounds, personalized
    b. Repeat above question asking caregivers about the website instead of the device.

Appendix G. Ethics approval from the University of Ottawa REB

File Number: H03-14-06 **Date (mm/dd/yyyy):** 08/07/2014

Université d'Ottawa University of Ottawa
Service de subventions de recherche et déontologie Research Grants and Ethics Services

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Linda J.	Garcia	Health Sciences / Others	Supervisor
Annie	Robitaille	Social Sciences / Psychology	Co-investigator
Miriam	Goubran	Health Sciences / Others	Student Researcher

File Number: H03-14-06

Type of Project: Master's Thesis

Title: Evaluation of a Touchscreen Assistive Device for People with Dementia: A Pilot Study

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
05/08/2014	05/07/2015	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:

As of August 7th, 2014, full ethics approval has been granted and research activities at all sites may begin as outlined in the ethics application.

Appendix H. Ethics renewal (2016) from the University of Ottawa REB

File Number: H03-14-06 **Date (mm/dd/yyyy):** 05/11/2015

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Linda J.	Garcia	Health Sciences / Others	Supervisor
Annie	Robitaille	Social Sciences / Psychology	Co-investigator
Miriam	Goubran	Health Sciences / Others	Student Researcher

File Number: H03-14-06

Type of Project: Master's Thesis

Title: Evaluation of a Touchscreen Assistive Device for People with Dementia: A Pilot Study

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
05/11/2015	05/10/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

Appendix I. Ethics renewal (2017) from the University of Ottawa REB

File Number: H03-14-06 **Date (mm/dd/yyyy):** 04/28/2016

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Linda J.	Garcia	Health Sciences / Others	Supervisor
Annie	Robitaille	Social Sciences / Psychology	Co-investigator
Miriam	Goubran	Health Sciences / Others	Student Researcher

File Number: H03-14-06

Type of Project: Master's Thesis

Title: Evaluation of a Touchscreen Assistive Device for People with Dementia: A Pilot Study

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
05/11/2016	05/10/2017	Approved

Special Conditions / Comments:
N/A

Appendix J. Ethics approval from the Bruyere Continuing Care REB

August 5, 2014

Miss. Miriam Goubran
Student, Interdisciplinary School of Health Sciences
University of Ottawa

Re: Evaluation of a Touchscreen Assistive Device for People with Dementia: A Pilot Study.
(Bruyère REB Protocol # M16-14-025)

Final Approval

Dear Miss. Goubran,

Thank you for your response to our conditional approval letter. With the revisions, the application has satisfied all ethical requirements.

As such, the Bruyère Continuing Care Research Ethics Board (REB) is pleased to give you ethical approval for the period August 5, 2014 to August 5, 2015.

We also approve the additional revisions you have made to sections 3.1(5) and 3.9.

Please provide us with a copy of the final approval letter from the University of Ottawa once received.

Please be advised that any complaints made by participants must be reported to the REB.

All changes to the approved protocol must be approved by the REB.

Please complete an Annual Project Update/Notification of Termination form by the approval end date as noted above.

We wish you the best of luck with your research endeavors.

Sincerely,

Appendix K. Ethics renewal from the Bruyere Continuing Care

July 14, 2015

Miss. Miriam Goubran
Student, Interdisciplinary School of Health Sciences
University of Ottawa

Re: Evaluation of a Touchscreen Assistive Device for People with Dementia: A Pilot Study.
(Bruyère REB Protocol # M16-14-025)

Renewal/Extension Approval

Dear Miss. Goubran,

Thank-you for submitting the Annual Project Update form for the above named study.

The Bruyère Continuing Care Research Ethics Board (REB) is pleased to extend ethical approval for the above-named project from August 6, 2015 to August 6, 2016.

We wish you best of luck as you proceed with this study.

Sincerely,