Acceptability of memory-aid technological devices for community-dwelling older adults with dementia to maintain quality of life.

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Dedication

In memory of my mum and dad. I want you to know that your girl has reached the heights that was not thought possible in our family. You would have been so proud. Thank you for believing in me. You will forever occupy a special place in my heart.

Preface

The discipline of health psychology, which relates to applying psychology's theories, methods, and knowledge to issues of health, illness, and health care, is rapidly growing. Prior to the commencement of my training in November 2018, I had over 20 years of experience working with diverse populations, which include people with mental health, physical disabilities, learning disabilities, people with dementia etc. During my training, I worked with older adults aged 70 and over living within a retirement community. Working in this setting was a rewarding opportunity. I saw how much I grew during my training and identified diverse areas in which health psychology could make a difference in people's well-being.

I developed skills through workshops, doctoral training schools, and regular supervision during my four-year training. In order to achieve my Professional doctorate training in health psychology, I developed competencies in the following modules: professional skills, teaching and training, consultancy, psychological interventions, systematic review and research projects that were assessed through essays, reflective essays, reports from supervisors and log books.

I achieved my professional skills competence at my workplace as a service manager at a retirement living development where I worked with a healthcare staff team, older adults and other healthcare and non-healthcare professionals. My work gave me countless opportunities to develop my professional skills, which I highly valued. The competence of this module was assessed through a logbook covering over two years of training and a reflective essay.

I fulfilled my teaching and training competence by delivering sessions with healthcare staff teams and health awareness sessions to different retirement living developments. I also worked with older adults in my work setting to develop group psychological interventions and carried out one-to-one intervention sessions. I achieved both competencies through logbooks, supervision and reflective essays.

I also had an opportunity of working with Public Health England in the Hertfordshire Behaviour Change Unit as part of my consultancy module, whereby I participated in a project for Hertfordshire Growth Hub. I co-authored a guide titled: “Wellbeing in Challenging Times”, https://www.yhphnetwork.co.uk/media/72558/wellbeing-in-challenging-times.pdf.

This guide was to support providers, employers and business owners with well-being and mental health training during the challenges of covid-19 pandemic. Secondly, I delivered online Psychosocial Skills training sessions to Hertfordshire Growth Hub business support advisors. I also delivered a careers session for MSc Applied Health Psychology Students at the University of Bedfordshire. These opportunities helped me achieve my competencies and gave me great insight into diverse areas where health psychology can be applied.

My research competence included a systematic review I carried out titled “Effectiveness of technology-based interventions to improve quality of life for elderly people with dementia in independent living settings. Therefore, the following research project I carried out within retirement living communities of older adults will fulfil my professional doctorate in health psychology training.

Acceptability of memory-aid technological devices for community-dwelling older adults with dementia to maintain quality of life

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Abstract

The rising prevalence of dementia cases due to ageing population presents a global challenge. Despite different types of memory aid devices available, evidence reveal that it is not widely accepted (Thordardottir et al., 2019). The current study aimed to understand the attitudes of people living with dementia and mild cognitive impairment (MCI) living in the community and caregivers on the factors influencing memory aid technologies acceptance.

A mixed research method was employed which used online survey data from 119 caregivers of people living with dementia for the quantitative approach, and the qualitative approach involved nine people living with dementia and MCI who were provided with a digital memory prompting calendar to provide their opinions based on a type of memory-aid technological device.

Results: the multiple regression analysis revealed that the technology acceptance model significantly predicted technology acceptance; perceived usefulness: $\beta = .264$, $t\ (113) = 3.623$, $p < .001$; perceived ease of use: $\beta = .422$, $t\ (113) = 6.059$, $p < .001$; and attitudes: $\beta = .387$, $t\ (113) = 5.763$, $p < .001$. Also, caregivers' sense of competence; $\beta = -.024$, $t\ (113) = -2.471$, $p = .015$; age; $\beta = .331$, $t\ (114) = 2.431$, $p=.017$; and dementia severity: $\beta =.145$, $t\ (114) = 4.521$, $p < .001$ significantly predicted technology acceptance. However, experience with technology, $\beta =.036$, $t\ (114) = .330$, $p=.724$; technology possession, $\beta=-.068$, $t\ (114) = -.234$, $p = .815$; and education, $\beta=.036$, $t\ (114) =.330$, $p=.724$, did not significantly predict technology acceptance. The Chi-Squared analysis revealed that technology access was not significantly

associated with household income, X^2 (5, 119) = 4.822, p = 0.438. The thematic analysis findings from the qualitative approach identified three themes; (1) self-preservation of dignity as illustrated by; "*I think a lot of people cannot or will not admit that they are losing their marbles"*, (2) past the age of learning as illustrated by "*I'm sure they are very useful to a younger generation"*, and (3) attitudes towards memory aid technologies as illustrated by; *"Who would need one of those".* These demonstrated that the relationship with technology was complex and self-protective.

While this study has shown that memory aid technologies possess the potential of playing a significant role in dementia care, there are issues around its acceptance at the cost of diminishing the users' sense of dignity because of the dementia it signifies. Future memory aid developments are recommended to be inclusive of intended users, clinicians and academic professionals to be involved in order to develop socially acceptable devices that could make the devices more acceptable.

CHAPTER ONE

1.1 Introduction

Ageing is increasingly prevalent worldwide, and so are the challenges of neurocognitive disorders which result in dementia and mild cognitive decline (MCI) (World Health Organisation, 2018). The increase in prevalence of these disorders is a global concern with the growing number of people living longer than before (World Health Organisation, 2018). In the UK, it is estimated that 850 000 people are living with dementia and MCI ("Statistics about dementia and MCI | Dementia and MCI Statistics Hub", 2020). However, this estimate does not include that of people living with undiagnosed dementia who have MCI which means that the number could be substantially higher. These statistics are estimated to rise to 1 million people by 2025 and set to double to 2million by 2051 ("Statistics about dementia and MCI | Dementia and MCI Statistics Hub", 2020). As the effects of dementia and MCI often results in people needing support to manage their daily tasks, it presents a global need to find solutions on effective ways to support the vast majority of people affected to enable them remain independent for longer. In the UK, there are over 700 000 informal caregivers who are family members or friends of people with dementia and MCI (Lewis et al., 2014). Due to the growing number of people living with dementia and MCI, there is an increased need to reduce caregivers' workload to support their loved ones to remain living in their homes for as long as possible. There is a sustained interest in assistive technology in dementia care which has been fuelled by the urgent need to develop useful approaches to help support people with dementia and MCI at home. With the global ageing population on the rise, it is predicted that over 2 billion people will need at least one assistive technology by 2030 (World Health Organisation, 2018).

Dementia describes a range of conditions that causes damage to a person's brain and affects their cognitive abilities (Lynn et al., 2019). This can affect people's memory, thinking, reasoning, and their ability to fulfil their daily routines (Lynn et al., 2019). There are different types of dementia which include vascular dementia, Lewy body, front-temporal lobe, and Alzheimer's disease (being the most common). Currently, there is no cure for dementia and the risk of its development rises with age therefore, is most prevalent in older populations (Lynn et al., 2019). Mild cognitive impairment (MCI) is a condition in which an individual has a decline in the functioning of their brain, but can still remain capable of managing independently their daily tasks (Boyle, 2014). The effects of dementia and MCI are characterised by deterioration in cognitive functioning which often results in memory loss that can lead to decline in self-care, mobility, and interpersonal relationships. This deterioration can result in the person affected to rely on caregivers and they may lose their capability to perform their daily tasks such as; remembering to take medication, attending appointments, attending to personal care etc (Kenigsberg et al., 2017). These effects can be devastating as individuals might become distressed, frustrated, depressed and can impact their quality of life (Andersen et al., 2004; Nauha et al., 2018). Consequently, this also affects family members and friends who might end up being caregivers of those affected to help them manage their everyday activities (Bennett et al.,2017). While caregivers are often family members who might feel obligated to support their loved ones, it results in additional responsibilities to add on to their daily tasks. This also might cause the caregivers to become worried about the safety and well-being of their loved ones which might also impact their quality of life (Andersen et al., 2004; Nauha et al., 2018). Caregivers may end up providing cognitive prompting, reminding and supporting their loved ones which can become burdensome as the disease progresses (O'Neil & Gillespie, 2008). Dementia is almost always viewed in connection with old age and evidence has highlighted that some people affected may have feelings of fear, shame and guilt which are commonly associated with dementia which can result in people distancing themselves socially (Low & Purwaningrum, 2020). These emotions may also be partly associated with feelings around increased dependency. Furthermore, social perceptions of dementia which can also partly result from the way in which dementia is referenced in literature, media and news might be an additional contribution to these emotions (Low & Purwaningrum, 2020).

1.1.1 Defining assistive technologies

Assistive technologies are devices that can help people with disabilities to function more independently (WHO, 2018). The term assistive technology covers a diverse area of systems and services associated with the delivery of assistive products and services (WHO, 2018). These products can enable individuals to manage their daily tasks better than they would have without them, and can help in promoting their wellbeing and improve their quality of life. Examples of assistive technologies range from non-electronic devices such as wheelchairs, to electronic devices or systems such as digital memory prompting calendars, smart phones and touchscreen tablets which can be used to support people to maintain their independence, safety and wellbeing (Nauha et al., 2018). There is a wide range of electronic assistive technologies which use prompters and reminders such as for date and time, medication and appointments. These can be used by individuals who find it difficult remembering and following sequences of performing certain everyday tasks (Begum et al., 2013; Perilli et al., 2013; Lancioni et al., 2014; Lancioni et al., 2009).

Assistive technologies such as prompters and reminders can play an important role in supporting the independence and care of people living with dementia and MCI and could potentially help delay entry to residential care (Malinowsky, et al., 2014). This means that people living with dementia and MCI could use them to perform daily tasks and manage their schedules that they would otherwise not have managed without additional support from caregivers (Perilli et al., 2013; Lancioni et al., 2014; Lancioni et al., 2009). These can help both the caregivers and people with dementia and MCI as they can be used as tools for technological interventions to enable greater independence. The presence of these technological interventions could potentially compensate for memory loss enabling people with dementia and MCI to manage some of their daily activities and make them less dependent on others (Kenigsberg et al., 2017).

This could enhance their quality of life, maintain their level of independence, reduce caregivers’ workload and might also reduce their levels of worry and anxieties over their loved ones.

1.1.2 Technology use behaviours among older adults with dementia

Currently, there is a growing interest to promote technology use in older adults with dementia and MCI due to the rise in aging population as well as the fast rate at which technology is advancing. These trends have led many to believe that technology has an important part to play to improve older adults' quality of life and independence while reducing costs for caring for them (Schulz et al., 2014). Evidence has shown that there is a rise of technology use in older adults such as mobile phones and internet usage amongst the older adults. For instance, Age UK (2018) reported that more older adults now use the internet with a significant rise for ages between 65 to 74 years increasing from 52% in 2011 to 83% in 2016, and over 75 years rising from 20% to 47%. Similarly, the use of mobile phones (including smart phones) amongst older people is widespread with half of adults aged between 65 to 74 and a quarter of those aged over 75 using one in 2019 (Ofcom, 2020). While these advancements indicate a shift in how technology is viewed among older adults, it is imperative to understand what type of technology is most popular and the reasons for its acceptance.

Literature which has sought to understand the most common types of technology-based interventions available to support people living with dementia and MCI has found memory aid technologies at the top (Evans et al.,2015). The development of these types of technologies are mostly targeted for older adults with dementia and MCI. This is because older adults are thought to require assistive technologies more than other population age groups as older age is more generally associated with various aspects of cognitive performance decline (Evans et al.,2015). These technologies have been tested to assess their effectiveness in terms of its efficiency in what it was developed for and have been found to be effective. For instance, a recent review aimed at evaluating the effectiveness of technology-based prompting devices revealed that there were now different technological systems available which could provide step by step guidance and support for people with dementia and MCI that could be applied daily (Lancioni et al., 2021). This review revealed that prompting technology on people with dementia and MCI effectively supported people with dementia to carry out some daily tasks (Lancioni et al., 2021). While the attempts of having technologies available aimed to solve problems associated with dementia and MCI are commendable, the true effects of these devices can only yield positive outcomes when they are accepted and continually used.

1.1.3 Memory-aid technologies

Memory aid technologies (MAT) are assistive technologies that can be used to compensate for memory loss, and can assist people with dementia and MCI to live independently without much reliance on caregivers (Malinowsky, et al., 2014). When it comes to MAT they are mainly targeted for older adults with dementia and MCI, and these MAT are the most common types to be developed which are also most commonly researched on among other assistive technologies (Evans et al.,2015). This is because dementia and MCI mainly affects cognitive functioning that mostly results in memory loss. These MATs are viewed to be effective in enabling people with dementia and MCI to maintain their independence, reduce the need for caregivers to be constantly reminding them to carry out certain tasks, and reduce their worries about their adherence such as taking medications (Evans et al.,2015). A recent review of new studies was carried out during the Covid-19 pandemic found that MAT could provide for cognitive function to support people with dementia and MCI and could improve quality of life (Pappadà, Chattat, Chirico, Valente & Ottoboni, 2021).

Further evidence has supported that MAT have the assistive potential to support people living with dementia and MCI by maintaining their independence to carry out tasks for daily living, to maintain quality of life (Begum et al., 2013; Perilli et al., 2013; Lancioni et al., 2014; Lancioni et al., 2009). Most people affected would prefer to continue living in their own homes while they receive support from caregivers with tasks for daily living (Kenigsberg et al., 2017). Currently, there are different types of MAT in various forms which include; digital calendars, speaking watches, touchscreen tablets, smart phones and robots. The potential impact of MAT has been vastly supported and, in the UK, there is a political drive to promote its utilisation which has influence on government policy. For instance, in 2009 the National Dementia and MCI Strategy for England conference was themed "*Living well with dementia and MCI*". Its main focus was to find ways to support people living with dementia and MCI to improve their quality of life by establishing ways to continue to live independently in their own homes. The successful utilisation of these MAT would subsequently reduce care costs, reduce caregiver burden, and help people maintain their independence for longer while maintaining their quality of life (Peek et al., 2014; Orpwood et al., 2007; Czarnuch & Mihailidis, 2011). While evidence point the potential in MAT, understanding the acceptance of these MAT is important for its successful deployment and utilisation. However plausible this might be having devices in place to help compensate for memory loss, having an understanding of how to promote behaviours to adopt using such MAT would make a significant contribution in dementia care.

Despite literature showing that MAT have the potential to support people living with dementia and MCI, evidence has shown low acceptance (Fox & Connolly, 2018; Morris et al.,2013; Thordardottir et al., 2019; Dequenter et al., 2022). While there are different types of MAT available, there is limited evidence to help understand what determines MAT acceptance by the targeted users which provides insight into the barriers encountered for low adoption behaviours (O'Neill et al., 2013). As there are numerous MAT devices available on the market (Holthe et al., 2018), it is important to understand the attitudes and thoughts of people with dementia and MCI regarding MAT (Bennett et al.,2017). Understanding these attitudes would help to inform future MAT developments and to implement effective interventions in dementia care.

1.1.4 Accessibility of memory aid technologies

In 2018, the World Health Organisation Director-General's report on improving access to MAT stated that only 1 in 10 of the people who needed MAT the most could have access to it (WHO, 2018). This has been accounted to high costs and a lack of financing, availability, ignorance and trained people to provide the support required (WHO, 2018). On the other hand, evidence has also revealed that there is greater technology access among high socioeconomic groups (Thordardottir et al., 2019; WHO, 2018). Furthermore, there is a wide variation of internet usage which shows that those from the high socio demographic groups use the internet much more than those from low socio demographic groups (Age UK, 2018; Ofcom, 2020). This revealed some inequalities which exists between different socioeconomic groups in accessing MAT. As these MAT are being developed to solve a global issue which might soon become a global crisis, facilitating for greater access would contribute to reduce to the likely impact of these issues. Presently, there is an urge to promote access to MAT for instance, a total of 175 state members obligated the United Nations Convention on the Rights of Persons with Disabilities to ensure that MAT was accessible at affordable costs for many to benefit (WHO, 2018). While it may be argued that MAT are at early stages of development, the fast pace in its development and its vast availability on the market requires evidence to understand low access for adoption (Egan & Pot, 2016).

1.2 Review of literature

Due to the prevalence in dementia cases in older populations and predicted increases of number of people affected, research has focused on identifying ways to effectively support people living with dementia and MCI to maintain their independence and quality of life. Literature has shown that MAT have been mostly researched on as they have been found to have the capability of supporting people with memory issues. For instance, a systematic review sought to understand the effectiveness of MAT interventions to improve independence, safety, communication, wellbeing and carer support in dementia care (Fleming & Sum, 2014). This review focused on studies that explored ways in which technology has been applied to help people with dementia to carry out tasks, its effectiveness in promoting independence and compensating for memory problems (Fleming & Sum, 2014). Though the results indicated that MAT did not make much of a difference for people with dementia, the findings revealed that there was lack of quality evidence which might have been due to the fact that MAT were at an early stage of development. Additionally, there were issues identified of moving from laboratory testing to real life use which possibly could have played a role in the way MAT was viewed.

Another systematic review sought to understand the barriers and facilitators of MAT acceptance among people with cognitive impairment and their caregivers. It revealed that people were willing to accept technologies that they were familiar with, and motivation was found to be an important factor for continued use of MAT (Thordardottir et al., 2019). On the other hand, this review also revealed some barriers to MAT acceptance namely; older age, low maturity of the MAT, little experience with technologies in general, lack of personalization, and support. In their recommendations, the authors stated the importance of the need for people to be equipped with knowledge of MAT available and how they could benefit from using it before they could accept it. Additionally, another review which focused on MAT for people with dementia revealed that MAT had the potential of supporting people with memory issues (King & Dwan, 2017). These findings however revealed that there were issues of having small sample sizes in the studies involved which restricted the generalisation of the findings; the majority of the studies mainly focused on the effectiveness of the devices rather than evaluating the outcomes for daily functioning; and there were only few studies that were conducted in home environments (King & Dwan, 2017).

Furthermore, König et al., (2021) also highlighted that most research evaluated the efficacy of the new MAT devices but they were not tested in home environments. The study by König et al., (2021) aimed to evaluate how MAT was perceived for everyday living by users in home environments and to understand the factors which played a role in acceptance and rejection. Though the findings revealed that there were no changes in the users' activities for daily living and no changes in caregiver burden, it showed that successful implementation of MAT was determined by positive attitudes towards MAT and perceived usefulness (König et al., 2021). The study also revealed that the outlook of the device impacted the way it was viewed and accepted as the way it was designed did not expose their condition which was rather stigmatising. Therefore, the participants had positive attitudes towards the device. This suggested that the design of these devices was important in the way that it appealed to be accepted. The participants showed interest in technological solutions and acknowledged perceived usefulness in maintaining independence however, they stated that they intended to use it in future (König et al., 2021). While this study sought to cover the gap by evaluating the devices in home environments and focused on outcomes for everyday life than just on the efficacy of the MAT, there were still issues of small sample sizes raised.

Another recent review that was carried out by Barbosa et al., (2023) evaluated evidence regarding the type of technologies that were used during the covid-19 pandemic by people with dementia and their caregivers. The review also sought to explore how these technologies were used and factors which affected the acceptance of technologies. The results showed that the pandemic played a role in increasing technology use among people with dementia and caregivers. However, there were issues with the quality of evidence as they stated that it was not robust and could not be easily generalised. The review also identified barriers such as lack of familiarity, experience, dementia stage and lack of interest that influenced technology adoption. However, the support from caregivers helped to overcome some of these barriers. On the other hand, the caregivers found it time-consuming and additional burden. One of the recommendations raised was the need to involve target populations to evaluate these technologies in order to understand their needs before deployment. Additionally, Cuffaro et al., (2020) cited in Barbosa et al., (2023) recommended that it was important to first identify the needs of those with dementia and their caregivers in order to establish more technological strategies for their support.

While evidence has shown that MAT could facilitate for improvement in quality of life for people living with dementia, there are issues of low quality of evidence available and MAT not evaluated for daily functioning in home environments. These requires further investigations to understand issues around sampling and the effectiveness of MAT in home environments.

1.2.1 Attitudes towards dementia affecting MAT acceptance

Attitudes toward dementia has been implicated to influence acceptance of MAT. Dementia has been viewed as an undesirable natural way of ageing by some, it is felt that people might avoid any association which symbolises dementia (König et al., 2021). This is assumed to impact the way MAT is viewed within a society as it signified dementia and MCI on people who use it, and some might not want to acknowledge their condition (Czarnuch, Ricciardelli & Mihailidis, 2016; Cheston, 2013). The effects of cognitive impairment include social isolation which can leave people confined in their homes due to feelings of shame, insecurity and disorientation, memory loss, difficulties in recalling names, disturbed thinking and behaviours that are stigmatising (König et al., 2021; Garand et al., 2009). These can have a negative impact on the health status of people with dementia and MCI and people's attitudes towards MAT, and can cause people affected to be viewed as different within a community.

It is due to societal attitudes towards people with dementia that dementia has been recently considered to be viewed under the social model of disability (Thomas & Milligan, 2017). This is not so much so to do with the impairment resulting from dementia and MCI, but due to the barriers that people with dementia and MCI faced within the society. The social model of disability highlighted some barriers encountered by people who have some form of impairments to ensure equality and human rights laws were implemented and avoid inequalities (Thomas & Milligan, 2017). This model focused on identifying the social and physical barriers faced by people with disabilities within the community erected by other people within all social circles. It suggested that people with disabilities were socially marginalised, oppressed and excluded

(Thomas & Milligan, 2017). Similarly, people with dementia and MCI experienced a range of impairments which leads to disabling barriers which are caused by people's attitudes among other factors. In an effort to ensure that people with dementia and MCI were better understood and involved, and to establish ways of making people within the society change their perspectives about dementia and MCI, Joseph Rowntree Foundation (JRF) was established (Thomas & Milligan, 2017). This foundation had a focus to facilitate for a better environment for people with dementia and MCI to live in. The cognitive impairments associated with dementia and MCI were viewed to cause these social barriers and exclusions which were due to lack of knowledge and understanding about dementia and MCI. Having MAT to support with remembering daily activities might expose their condition to people in the community they might not want to know for fear of being treated differently. Therefore, researchers were encouraged to focus more on everyday experiences of people with dementia and MCI and their perspectives to understand the challenges they faced (Brittain et al., 2010; Boyle, 2014). In light of this, it is crucial to understand older adults' attitudes on MAT as this might play an important role in understanding acceptance. Having MAT to support with remembering daily activities might expose their condition to people in the community they might not want to know for fear of being treated differently.

1.2.1.1 Dementia Stigma

Stigmatisation involves the labelling of individual differences, the negative evaluation of those differences by others, others' adverse reactions, and negative social and emotional outcomes for the affected individual (Graham at el., 2003). Stigmatisation in dementia can happen through negative stereotypical views that are associated with decline in memory. This can result in individuals affected to be considered as incapable of living independently and that they are no longer capable of contributing within their community (Nguyen, 2020). Initiatives such as 'The Alzheimer Society Dementia Friend' was put in place to help people understand about dementia and to change their perspective (Heward, Innes, Cutler & Hambidge, 2017). This was put in place to educate members of the community about dementia that would help transform their thoughts, actions and discussions about dementia. Having people to understand the key information about dementia would help to change perceptions about the condition which overcome the stigma associated with dementia (Heward et al., 2017).

Czarnuch et al., (2016) advocated that people with dementia and MCI should not be treated differently because of their diagnosis as this might result in the individuals being excluded from social roles and activities. A survey participated by 1000 individuals revealed that 81% thought that they would be looked upon or treated differently if other people knew that they were diagnosed with dementia (Crisp et al., 2000). Such reactions from the community can be a driving factor that might cause people not to be interested in utilising technological devices especially focused for people with dementia and MCI.

Another report revealed that due to people with dementia being treated differently, the All Party-Parliamentary Group (APPG) was created to ensure that the rights of people with dementia were protected and should not be treated differently (APPG on Dementia report, 2019). They proposed making changes for people with dementia by adopting the rights-based approach guided by the social model of disability framework to implement these changes (APPG on Dementia report, 2019). This involved using the Dementia Statements based from the perspectives of people with dementia and their caregivers. Recognising dementia as a disability has been advocated to expose and remove the social barriers that restricted people with dementia from living independently. The insight from the statements revealed that people felt that the society defined them by their condition and were living in shame because of it. The views from the people who responded to the APPG enquiry revealed that people with dementia faced stigmatisation due to lack of understanding about dementia within the society. The report also revealed that the participants felt that they were treated differently than those with other health conditions and disabilities. This showed that there was lack of awareness within society about dementia and people's legal rights. People affected might end up being fearful of losing their status within the society and might feel discrimination which interferes with their ability to participate fully in the social and economic life of their community (Graham at el., 2003). These attitudes consequently lead people to resent anything that reminds them of dementia and the things that might raise people's suspicions about their diagnosis. Stigma associated with using the device, can be a barrier to acceptance and use. Memory aids signal that the user has memory issues, as much as other aids such as wheelchairs and walking sticks which signal mobility issues (Charness, Best & Souders, 2012).

1.2.2 The role of caregivers

Caregivers' views play a fundamental role in influencing MAT acceptance for people with dementia and MCI therefor. It is important to understand the factors involved in MAT acceptance and the factors determining its accessibility (Sriram, Jenkinson & Peters, 2019). The responsibilities of providing support for people with dementia and MCI increases the risk of caregiver burden which can lead caregivers to worry about their competences to provide support to their loved ones (Sriram et al., 2019; Vernooij-Dassen et al., 1999). Since most family caregivers were not trained to care for their loved ones, it has been suggested that they are often concerned about assessing the consequences of their involvement in care, their satisfaction with their own performance as caregivers, as well as the satisfaction with people with dementia and MCI as recipients of care (Vernooij-Dassen et al., 1999). Caregivers were viewed to be motivated to accept MAT for the people they cared for when they felt that they were not providing adequate support to their loved ones (Sriram et al., 2019). However, some caregivers lacked knowledge of different types of MAT available and others lacked confidence in using technology which impacted their technology acceptance (Sriram et al., 2019). Furthermore, it was argued that most caregivers were open-minded when it comes to technologies however, access was restricted due to information gap resulting in lack of awareness of what was available to support the people they cared for (Kramer, 2013). For instance, some caregivers indicated that they were not aware of MAT available to support their loved ones otherwise they would have considered using it (Kramer, 2013). This suggests that caregivers were motivated to find ways to provide support for the people they care for to enhance their quality of life, maintain their independence and reduce the number of responsibilities.

Another study revealed that for the successful deployment of technologies, it was crucial to have caregivers who were willing to get involved, to acquire knowledge as well as to assist the people they supported. One reason to explain this was revealed in a qualitative study which sought to understand what influenced MAT adoption behaviour found that successful adoption of technology in older adults with MCI was mainly based on need (Dequenter et al., 2022). This meant that when caregivers felt the need for additional support for the people they cared for, they were motivated to promote MAT to the people they support. In addition, this study also revealed that the awareness of dementia, the capability to adopt MAT and social support available played an important role on people's perceptions towards MAT (Dequenter et al., 2022).

1.2.3 The role of sociodemographic factors

While issues of affordability have been implicated to making a contribution in the access of MAT, other socio-demographic factors have been said to play a role in technology acceptance. For instance, a systematic review revealed several facilitators of technology acceptance which included motivation, perception of effectiveness and low technical demands; while older age, unfamiliarity of technology, lack of experience with technology and lack of support represented barriers (Thordardottir et al., 2019). Furthermore gender, education, normal cognitive functioning has also been implicated as barriers (Berner et al., 2015; König, Seifert & Doh, 2018). Higher levels of education is one factor suggested to play a role in MAT acceptance (König et al., 2018). People with higher levels of education have been said to positively influence perceptions on technology. On the other hand, lack of experience with technology was a barrier to technology acceptance (Thordardottir et al., 2019). Many older adults were viewed as lacking experience with technology as few had access to it during the time of their careers. Therefore, they felt incompetent to handle MAT because of lack of exposure (Peek et al., 2014). The level of dementia severity was considered to play a role in MAT acceptance. A qualitative study which aimed to identify the determinants of technology acceptance, shows that one of the important factors of MAT acceptance was having the cognitive ability to adopt and continue to use technology played a role (Dequenter et al., 2022). Otherwise, it would not be meaningful for the intended uses if they no longer have the capability to understand what technology represented, as evidence revealed that greater cognitive impairment caused people to use technology less (Calvert, Kaye & Leahy, 2011). As dementia and MCI is known to be progressive, people with dementia and MCI may lose their capability to learn new things which might restrict their acceptance of AT (Meiland et al., 2017).

Age has been said to influence technology usage as stated in a study which showed that younger age groups used technology more than the older age group (Berner et al., 2015). For instance, Chen and Chan (2011) showed that different age groups had different perceptions of technology which likely influence their acceptance. Therefore, when it comes to acceptance of technologies, most older people have low self-esteem and consider themselves to lack experience (Chen & Chan 2011; Mitzner et al., 2010; Czaja et al., 2006), which suggested that older adults are not well disposed to technologies that can be a contributing factor to MAT acceptance.

Research has shown that there are many interacting factors at play that contribute to MAT acceptance. In addition to the socio demographic factors, ethnicity and the community in which people resided also play a role in how MAT was viewed and accepted (Czarnuch et al.,2016). It is important understand how people in different community settings and ethnic groups people make meaning of these technologies. Furthermore, Meiland et al., (2017) highlighted the importance of understanding the needs of the people these technologies are targeted for. These are not just their physical needs but emotional and psychological needs. For instance, people valued their sense of self-worth, self-esteem and being respected (Meiland et al., 2017). These attributes according to Maslow's 'hierarchy of needs' are crucial for an individual's well-being and quality of life (Meiland et al., 2017). It is important for people with dementia and MCI to be able to express their needs and preferences.

While studies have been conducted to determine the effectiveness of memory aid technologies amongst other MAT, it is considered important to highlight that use of psychological theories to guide the research has been limited. In an attempt to understand low acceptance of MAT, Christie et al., (2018) highlighted a gap between theory directing research and the successful implementation of MAT in everyday life. A latest review by Pappadà et al., (2021) highlighted the need for more studies guided by theoretical models. They argued that the increase in use of theoretical models would help to uncover and understand the underlying psychological factors involved in MAT acceptance. The use of theoretical framework is to contribute by providing knowledge to incorporate psychological theory into practise to help understand people's attitudes and behaviour. This might help to direct future technology developments that could be effectively be used in dementia care. For instance, a review to establish whether MAT could help people with dementia and MCI compensate their memory loss revealed that most literature focused on the development of MAT, while other literature mainly focused on identifying the effective types and design of MAT (Van der Roest et al., 2017). This suggests that technology developers were mainly involved in these researches who might lack knowledge of theoretical models. Psychological models are fundamental in understanding the processes involved in user attitudes and behaviours towards MAT. This would help to determine future technological interventions that could be developed to support people to accept using MAT that would empower people to maintain some control over their life.

1.3 Psychological Models to help understand technology acceptance

There are different psychological models that can be used within the field of health psychology to understand behaviour change factors. For instance, the COM-B model of behaviour change is one of the psychological models that has been designed to help understand what drives decisions to make behaviour changes (Michie, Atkins & West, 2014). For people to change behaviour such as the adaptation to new technology, the COM-B model argued that three core conditions need to be satisfied: capability, opportunity and motivation (Michie et al., 2014). The model suggests that for a behaviour to change, an individual needed to believe that they were capable both psychologically and physically to engage the behaviour. Also, they would need to have the opportunity both physically and socially to facilitate for the behaviour change, and they would need to be motivated to want to engage the behaviour. Capability related to whether an individual had the knowledge, abilities and the skills to be able to engage in the behaviour. Opportunity required the conditions that facilitated for people to have access to technology which can involve external factors that can facilitate for the behaviour to become possible to execute. Motivation can involve individuals' internal processes that might influence the decision. People can be motivated to engage in technology they find interesting and might be willing to learn. In addition, social support such as caregivers can play a role in motivating the people, they support to use technology. If the caregivers themselves have positive attitudes towards technology, they will likely acquire it and motivate the people they care for to use it.

Other theories such as the Theory of Planned Behaviour (Fishbein & Ajzen, 1975), the Theory of Reasoned Action, the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003; 2012), and the Technology Acceptance Model (Davis 1989; Davis, Bagozzi & Warshaw, 1989) have been used to understand technology adoption behaviours. For instance, the theory of planned behaviour has been used to understand the psychological processes involved in people having intentions to engage in certain behaviours. The Unified Theory of Acceptance and Use of Technology also integrates different psychological theories to comprehensively identify the factors involved in behaviour change. And the theory of reasoned action suggests individuals' intentions to engage in certain behaviours. According to the theory of reasoned action, one's engagement in a certain behaviour is determined by the individual's attitude and subjective norms. These theories have been used to understand technology adoption behaviours. However, one of the most influential theories used to understand technology acceptance is the Technology Acceptance Model which is considered appropriate to guide this study. This model has been widely used in different settings to understand user acceptance in technology and has been found to have predictive abilities of user acceptance of technology (Legris, Ingham, & Collerette, 2003).

1.3.1 The Technology Acceptance Model (TAM)

TAM has been developed to enable people to understand and predict user behaviour of technology (Davis et al., 1989; Legris et al., 2003). This model is considered an influential extension of theory of reasoned action (Ajzen & Fishbein, 1980) which was adapted by Davis et al., (1989) in order to understand what drove people to accept or reject technologies. It suggested that people's intentions to use technology were based on their perceptions of the specific technology whether they perceived it useful and whether they perceived it easy to use (Davis et al., 1989). The Theory of Reasoned Action is one of the first theories to be applied in technology adoption. This theory proposed that behavioural intentions were driven by people's attitudes. The theory hypothesised that people's behaviours are influenced by their intentions, and the intentions are in turn influenced by the attitudes towards technology. The model took into consideration individuals' cognitive beliefs which are perceived usefulness and perceived ease of use. According to TAM, for an individual to use a technology system is likely directly or indirectly impacted by the user's behavioural intentions, attitudes, perceived usefulness of the system, and perceived ease of use. Individuals' intention to use technology determines the actual use of the application and attitudes toward technology affect the intention (Davis et al., 1989; Davis & Venkatesh, 2004; Venkatesh et al., 2012). The model also suggests that there are external factors that influence technology acceptance and user intentions to use technology. This however is mediated through perceived usefulness and perceived ease of use. TAM has been used in different studies seeking to explain technology acceptability among different users. This model has been used to explain different factors of technology acceptance that are transferable to different user populations and different types of technologies. The theory has also been used in older populations (Davis et al., 1989; Venkatesh et al., 2000) and has been widely used in different research settings and with different types of technology applications.

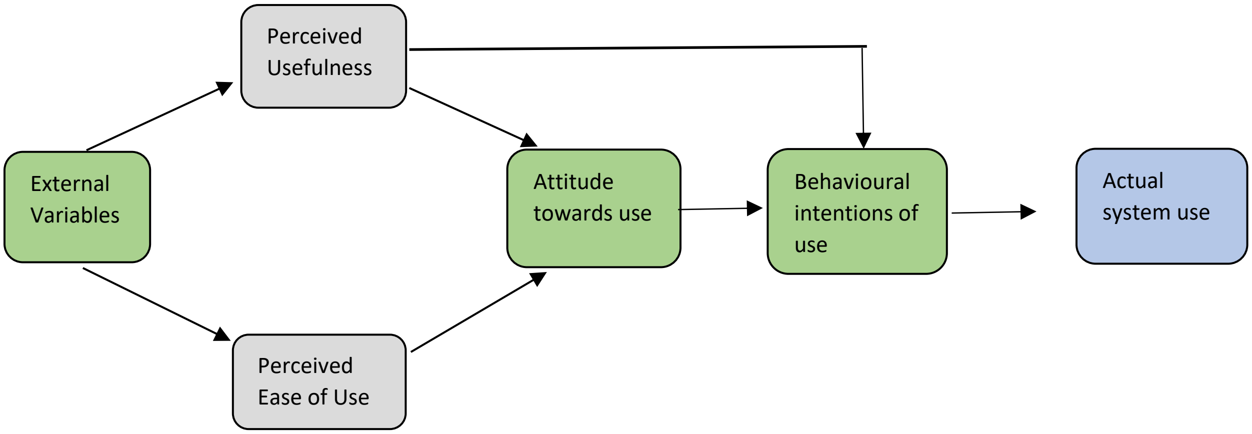

Fig 1.1 Technology Acceptance Model

TAM is based on two primary constructs that is said to influence people's intentions to use AT are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). TAM assumes that the actual use or intention to use the technology is determined in particular by the intended user's perceptions. PU is defined as the extent to which an individual believes that using a particular system is useful and will enhance the task performance. A review by Peek et al. (2014), targeting the general old population, revealed that the most important factors for technology acceptance were a perceived need for the technology and the expected benefits of its use. The second factor is PEOU which is defined as the extent to which a person believes that only little or no effort is required to use the technology (Venkatesh & Bala 2008). Ezer, Fisk and Rogers (2009)'s study indicated that both perceived usefulness and perceived ease of use have been found to be predictors of intentions of use on technology. Though not all studies have supported TAM, it provides a useful framework and has been consistent in several studies for instance a study which investigated factors influencing older adults' intentions to use new technology (Braun, 2013). PU and PEOU factors have been said to be influenced by various external variables such as level of education (Burton-Jones & Hubona, 2005) and, gender (Venkatesh & Morris, 2000; Venkatesh et al., 2012). TAM has been used for generating explanations for the factors of technology acceptance that are transferable to different user populations and different kinds of technologies. Many different contexts and research constructions have confirmed the validity of the TAM model (Ma & Liu, 2004; King & He, 2006), including in the health care industry (Chau & Hu, 2002; Chismar & Wiley-Patton, 2003). TAM will be used for the purpose of this study, to structure the research process and to help enhance the understanding of the acceptance of memory aid technologies in senior adults living with dementia and MCI.

1.4 Rationale for research and aims

Evidence has shown that AT can be effectively used as memory support by people with dementia and MCI however, there were a number of issues that were found:

- lack of quality studies
- lack of theoretical framework
- most studies mostly focused on qualitative and fewer quantitative studies
- most research focused on the effectiveness and feasibility of the devices developed but lacked intended users' views

Evidence has shown that there is lack of quality studies around MAT acceptance in people with dementia mainly because of having small sample sizes to provide robust evidence (Meiland et al., 2017; King & Dwan, 2017; Fleming & Sum, 2014; Thordardottir et al., 2019; König et al., 2021). Also, there are limited psychological theories in the design and evaluation of MAT and lack of robust evidence to reveal whether

MAT could be accepted to compensate for memory loss for people living with dementia and MCI (Van der Roest et al., 2017). For instance, the COM-B model of behaviour change proposed by Michie et al., (2014) which suggested the three components involved in behaviour change, could be used to understand what drives people to change behaviour and adapt to new technology; and TAM that could be used to predict people's likeliness to adapt to using MAT and to understand people's perceptions towards MAT which can influence its acceptance. Some have argued this to be due to the fact that MAT was at early stages of development, while others have argued that research was most likely conducted by researchers who lack psychological background (Egan & Pot, 2016). They mainly focused on identifying the suitable types of technologies while overlooking to seek to understand underlying psychological factors that affect MAT acceptance (Scherer et al., 2007). In addition, most studies that aimed to capture the perspectives of people living with dementia and MCI and caregivers have mainly focused on qualitative research methods which included pilot studies, experimental studies, observational and preliminary studies (Perilli et al., 2013; Nahua et al., 2018; Lancioni et al., 2014; Sriram et al., 2019). This however, was argued to be due to the potential challenges that the individuals with dementia and MCI are likely to encounter when completing the questionnaires without additional support to provide their views on the subject (Alwin et al., 2013). While these methods employed have been significant in contributing to the knowledge on the feasibility and effectiveness of MAT before putting them on the market, the issues of small population samples still remain unresolved. Moreover, concerns over the generalisability of the results have been raised due to small population samples often involved in qualitative studies. Furthermore, some have argued that studies have been mostly qualitative due to ethical issues when it comes to dealing with people with dementia and MCI ((Bennett et al., 2017; Sriram et al., 2019; Meiland et al., 2017). As obtaining authentic informed consent might fluctuate during the research process due to cognitive impairment, participants might need consistent reminding of their participation rights which can be difficult to carry in quantitative studies (Alwin et al., 2013). While this may well be the case, it is important to bear in mind that caregivers are often involved in most aspects of decision making. Therefore, their views significantly impact whether these technologies will be acceptable to the people they care for or not (Alwin et al., 2013). In addition to this, caregivers are usually family members who have known them for a long time to have good knowledge of what is likely acceptable to them and most importantly often make the decision whether to acquire the MAT or not. It is therefore important to evaluate the perspectives on MAT from both caregivers and people with dementia and MCI by utilising mixed research method which utilised both quantitative and qualitative method. This would help to obtain larger sample sizes while obtaining views of participants involved in the acceptance of MAT.

As dementia progresses, an individual may eventually find it difficult remembering to keep up with their daily tasks. MAT can be an effective memory support for people with dementia and MCI to manage their daily tasks without having someone to constantly remind them. They provide a cost-effective way to prolong independence of people with dementia and reduce carer burden which facilitates for quality of life. For these MAT to be successfully implemented, they need to be accepted by the targeted users. This research aimed to understand the attitudes of people with dementia and MCI and their caregivers towards MAT and the factors influencing acceptance of these types of technologies, and to understand the factors that play a role in the acceptance of MAT and to explain the role of caregivers towards accessing and acceptance of MAT.

1.4.1 Objectives

- To carry out online surveys on caregivers of people with dementia to explore:
- the relationship between caregiver’s sense of competence and their likeliness to accept MAT for people with dementia and MCI.

- the role of socio demographic characteristics (income, age, gender, educational levels, experience) and the acceptability of MAT.
- the relationship among perceived ease of use, perceived usefulness, and attitudes towards MAT acceptance.
- the role of income on technology accessibility.

- To carry out a qualitative investigation by providing a memory prompting digital calendar which is a type of MAT to people living with MCI and dementia in community settings. This is to enable them to experience its operations and to carry out interviews to explore factors playing a role in MAT acceptance based on their attitudes towards the device.

1.4.2 Hypotheses

- H1. There is positive relationship between higher levels of household income levels and MAT access.
- H2. There is a positive relationship between greater technology possession and MAT acceptance.
- H3. Greater levels attitudes towards MAT as measured by the technology acceptance model (TAM) scale constructs would significantly predict MAT acceptance.
- H4. Greater levels of perceived usefulness (PU) as measured by the TAM scale PU constructs will significantly predict MAT acceptance.
- H5. Greater levels of perceived ease of use (PEOU) as measured by the TAM scale PEOU constructs will significantly predict MAT acceptance.
- H6. Lower levels caregiver sense of competence as measured by the short sense of competence questionnaire will significantly predict MAT acceptance.
- H7. Greater young caregivers age group as measured by caregivers age will be positively associated with MAT acceptance.

- H8. Higher levels of education as measured by education levels will be positively associated with MAT acceptance.
- H9. Greater experience with technology as measured by experience levels will be positively associated with MAT acceptance.
- H10. Higher levels of dementia severity as measured by the clinical dementia rating scale will be positively associated with MAT acceptance.

CHAPTER TWO

2. Methodology

This chapter explains the mixed research method that was used for this study. It comprises of the qualitative and quantitative investigations which aims to understand what determines MAT acceptance in older adults with dementia and their caregivers. It then further explains how the outcomes are integrated to answer the research question. The details of the procedures for the qualitative investigation and the quantitative investigation are laid in the next two chapters respectively. Then the integration of the results and the discussion are found in chapter five.

This study utilised a mixed research method which is a research method that integrates both quantitative and qualitative methods in a single study to understand a research question (Creswell, 2012). It has been referred to as an "emergent methodology of research that advances the systematic integration, or "mixing," of quantitative and qualitative data within a single investigation" (Wisdom & Creswell, 2013 pp. 1). This research method originated within the social sciences and is becoming an increasingly popular method of research in other healthcare fields of research (Wisdom & Creswell, 2013). The researcher needs to be competent in using both the qualitative and the quantitative research in order to effectively utilise this method. This research method was identified to be relevant to obtain more generalisable findings (Wisdom & Creswell, 2013).

The general premise for utilising the mixed research method is underpinned by the ‘critical realism’ epistemology philosophical assumption. Critical realism is a philosophy of science which is based on several ontological principles and framed around the philosophy’s positivism and interpretivism (McEvoy & Richards, 2009). This approach highlights a deep understanding of any social situation which goes beyond what can be observed. It focuses on the exploration of reality using various structures and mechanisms based on what is experienced and observed to obtain insight in finding answers through an integrated approach (McEvoy & Richards, 2009). Critical realism differentiates the real world from the observable world. The world is framed based on human perspectives and experience through what is observable. Therefore, unobservable events cause observable events, understanding the structures generating the events would help people to understand the social world (McEvoy & Richards, 2009). Critical realism assumes that reality contains ontological assumptions based on three domains; empirical (observed and experienced events, understood through human interpretation), actual (reality that exist whether observed or not), real (causal mechanisms within objects or structures cause events at empirical level to occur) (Fletcher, 2017). The mixed research method can facilitate for several ontological principles through providing a platform to obtain greater insight into the area investigated by combining the elements of the quantitative and qualitative components. Therefore, the mixed research method was considered appropriate as it provided a more comprehensive and detailed knowledge into the subject being researched thus, validating the strength of the study (Johnson et al., 2007).

The type of the mixed design used was the convergent design (Fig 2.1). This design enabled the qualitative and quantitative data to be collected and analysed concurrently, then integrated the two databases by merging the results during data analysis at the point of integration (Noyes et al., 2019; Schoonenboom & Johnson, 2017). The point of integration is the stage in mixed method design whereby the qualitative and the quantitative components are brought together to explain the research question (Morse & Niehaus, 2009; Guest, 2013). The integration of both the qualitative and quantitative components, can provide a more comprehensive and intensified use of data, than just only the quantitative or qualitative data collection and analysis (Venkatesh, Brown, & Bala, 2013).

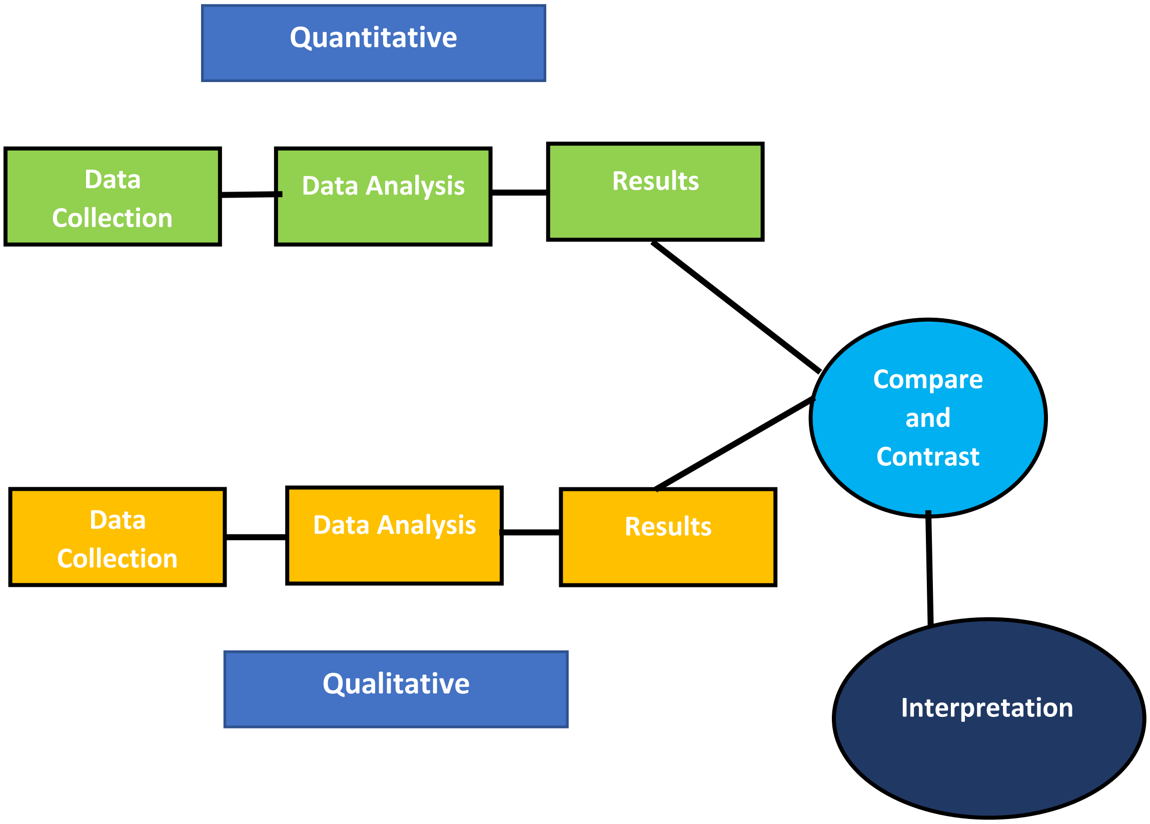

Fig 2.1 Mixed method research design approach (Adopted from Creswell (2012))

In this study, the mixed design approach quantitative data was collected from caregivers of people with dementia through online surveys, whereas the qualitative data was collected from people with dementia and MCI through the interviews. This study comprised of two investigative components namely, study 1 the quantitative investigation and study 2 the qualitative investigation. The findings from each study were then combined to obtain the broadest possible understanding which complimented each other in order to explain the research question. Combining these two methods contributed to the understanding of the factors which play a role in the utilisation of MAT. In addition to the insights from the quantitative survey, the qualitative study design complimented the numerical values with more in-depth insights.

The quantitative investigation in study 1 required caregivers to respond to a self-report online survey. The questions on the survey assessed caregivers' views and attitudes towards technology acceptance and the demographic factors' effects on acceptance and accessibility of MAT. Self-report surveys were made available on different online platforms which were completed by caregivers of people living with dementia. This approach facilitated for data to be collected from a larger sample size of caregivers to provide their open and broad views on MAT. Caregivers' views are often seen as closely representing the views of individuals they are caring for (Alwin et al., 2013). They play a huge role in decision making for the people they support as to whether these technologies can be acceptable however, their thoughts on assistive technologies have been largely overlooked (Huschilt & Clune, 2012). Caregivers are anticipated to be open-minded to new technologies as this could contribute to the independence for the people they care for, and reduce their reliance on them which subsequently could reduce their responsibilities in supporting (Kramer, 2013). Caregivers often act as gatekeepers, and if they have negative views on technology then it may not reach the individuals they are caring for (Huschilt & Clune, 2012). Therefore, it was important to obtain their thoughts on MAT as much as it was equally important to obtain the thoughts of people living with dementia and MCI. Even though these MATs can facilitate for some form of independence for people with dementia and MCI, the role of caregivers' support is still fundamental. They are needed to help to set up the technological devices such as setting the reminders, appointments, calendars, as well as supporting them to understand how to use them (Kramer, 2013). Their views and attitudes on memory aid technologies play a huge role in whether it is accepted or not. Also, their perceptions in terms of usability will also have a huge effect as to whether these technologies would be effectively utilised. Furthermore, since they most likely would know the capabilities of the people they are caring for, they were able to provide views which closely depicting whether AT is likely to be accepted.

The qualitative investigation involved exposing a digital memory calendar to people living with MCI and dementia so that they could experience how it worked, and was used as a reference point for this study. This was to provide the participants with a typical memory aid device that is targeted for people with dementia and MCI, which they could refer to when providing their opinions. This was to ensure that the participants had some knowledge of a typical memory aid device which also enabled those who hadn't seen one before to become familiar with this type of technological device. This was then followed by semi-structured interviews which helped to explore detailed individual perspectives on MAT. The interviews provided a rich and in-depth information on MAT on people with dementia and MCI based on their views of the memory aid digital calendar, and helped to gather information that would be hard to collect using quantitative approach (Creswell, 1998; Morse, 1994). Interviews also helped to clarify the interview questions and simplified them in a way that could be easily understood by people with dementia and MCI who might have required greater elaboration to understand. In addition, interviews offered adequate time to respond to questions that enabled an appropriate pace of the individual being interviewed (Hellström, Nolan, Nordenfelt & Lundh, 2007). The interview data collected was recorded using a smart phone, and the recorded data was then transcribed verbatim before being analysed and grouped according to the identified themes.

CHAPTER THREE

3. STUDY 1: Quantitative investigation

This chapter focuses on quantitative investigation of the research. Its focus is to gather information on caregivers of people living with dementia to understand how they contribute in technology acceptance for the people they care for. This comprised of a survey completed by caregivers of people with dementia. The first section of the survey comprised of demographic questions followed by validated questionnaires to obtain the participants' views. i.e., The Short Sense of Competence Questionnaire (SSCQ) questionnaire to obtain information about the impact of AT on experience of caregiver's competence); clinical dementia rating scale (CDRS) which is used to determine the dementia stage; and Technology Acceptance Model (TAM) scale to obtain the views on perceived ease of use, perceived usefulness, behavioural intention and attitudes, Park (2009). The TAM constructs were operationalized and measured using items derived from validated surveys from other studies and modified to fit the context of this study (Venkatesh & Davis, 2000).

3.1 Participants

A total of 119 participants took part in the survey. The sample comprised of caregivers of people aged 65years and over living with dementia within the community. It was acknowledged that some caregivers might not have internet access or have no interest in engaging on online social media platforms. Therefore, in order to be inclusive, offline recruitment was facilitated through paper surveys which were made available at some retirement living developments. This was an additional measure to reduced recruitment bias by ensuring to facilitate for caregivers who might not be present online, particularly older couples who might be living with their loved ones who they support.

All participants were recruited through online means as no participants were successfully recruited offline (Appendix 7). The minimum sample size was determined by using power analysis via G-Power computer software (Faul, Erdfelder, Lang & Buchner, 2007). To calculate the minimum sample size, the following parameters were involved: effect size of 0.15; alpha at 0.05 and the power at 0.80. As seen in table 1.2, 70% of the participants were recruited through the “Join Dementia Research” (JDR) platform delivered in partnership with the National Institute for Health Research. JDR is an online national platform where people can register their interest to participate in dementia research. The rest were recruited through online social network platforms (Facebook, LinkedIn, WhatsApp).

3.2 Materials

The materials that were used in this quantitative approach comprised of the following:

- G-Power 3.1 software (Faul et al., 2007) that was used to determine the minimum appropriate sample size.
- SPSS software used to analyse survey data
- Qualtrics software which was used to create the online surveys.
- The consent form which the participants were asked to sign electronically by ticking a box prior to completing the quantitative questionnaires as part of the online survey (Appendix 4.
- Participant information sheet which provided the participants with full details of the study, the eligible participants, etc. (Appendix 3)
- Data privacy notice for all participants which contained information about how data collected was handled and the plan in place to ensure that their identities were protected (Appendix 2).

3.2.1 Short Sense of Competence Questionnaire SSCQ:

Caregiver subjective competence was measured by the SSCQ (Vernooij-Dassen et al., 1999). This is a 7-item measure derived from a longer, 27-item Sense of Competence measure. This questionnaire consists of seven items rated on a 5-point scale (1 ‘agree very strongly’ to 5 ‘disagree very strongly’). Scores can range from 7 to 35 with a higher score indicating a higher sense of competence. These items reflect three domains of caregivers’ feelings of being capable of caring for a person with dementia: (a) *satisfaction with the person with dementia as a recipient of care:* “I feel that the person I support behaves the way they do to have their own way”, “I feel that the person I support behaves the way they do to annoy me”, “I feel that the person I support tries to manipulate me”. (b) *satisfaction with one’s own performance as a caregiver*: “I wish that the person I support and I had a better relationship”, “I feel strained in my interactions with the person I support”. (c) *consequences of involvement in care for the personal life of the caregiver*: “I feel that my present situation with the person I support doesn’t allow me as much privacy as I’d like”, “I feel stressed between trying to assist the person I support and other family responsibilities, job etc”.

3.2.2 Clinical Dementia Rating (CDR):

The CDR scale is used in staging dementia and evaluates cognitive, behavioural, and functional aspects of dementia. This scale has been found to be reliable when applied in non-clinical settings with non-medical personnel to determine the stage of dementia (Chaves et al., 2007; Yang et al., 2021). It consists of six domains of cognitive and functional performance: Memory, Orientation, Judgment & Problem Solving, Community Affairs, Home & Hobbies, and Personal Care. The ratings are based on a 5-point scale (0, 0.5, 1, 2, 3) on each domain except Personal Care which is rated on a 4-point scale (0,1,2,3). The overall score is derived by standard algorithm which is useful for globally staging the level of impairment: 0 = No impairment, 0.5, 1, 2, and 3 indicate Very Mild, Mild, Moderate and Severe Dementia (Morris, 1993), see appendix 8.

3.2.3 Technology Acceptance Model (TAM) scale:

The TAM scale has been used to evaluate people's attitudes towards technology and their likeliness to accept using it. The survey items include perceived usefulness (PU), perceived ease of use (PEOU), attitude (A), and intention to use (IOU). The questionnaire was adapted to the context of this study and is based on the constructs validated by Davis (1989). The questionnaire has been used and validated in previous studies showing reliability across the items and having strong predictive capabilities. This questionnaire consists of seven items rated on a 5-point scale (1 'agree very strongly' to 5 'disagree very strongly'). Each domain consisted of a possible a minimum score of 5 and maximum of 20 (Appendix 9).

3.3 Instrument reliability

The Cronbach's Alpha measures the reliability of the scales of how the items are closely related and values exceeding 0.60 were considered reliable (Ahdika, 2017). Therefore, the scales used from the data collected in this study revealed that the items had high internal consistencies as shown in Table 3.1.1.

Table 3.1.1 *Cronbach's Alpha values showing the reliability of the scales used.*

Variable name	**Cronbach's Alpha Values (for scales used)**
CDRS	**0.888**
SSCQ	**0.791**
PU	**0.959**
PEOU	**0.955**
IOU	**0.947**
ATT	**0.961**

3.4 Procedure

A computer-generated link from the Qualtrics software program was distributed through emails, social media (Facebook and twitter), WHATSAPP mobile phone App and SMS messaging inviting suitable participants. Necessary permission and researcher trainings required by the Join Dementia Research coordinated under the National Institute for Health Research to meet their terms for recruitment was done and approved (Appendix 10). This was obtained after completion of their guidelines and compliance training requirements in accordance to their procedures. Recruiting participants through JDR platform required the researcher to follow a rigorous process of providing details about the research which they will review with the evidence provided. After approval of the study, the researcher was required to undergo training on how to use their system with an assessment at the end which needed to be passed before given access to recruit. This was to ensure ethical compliance would be met during the recruitment process. Once all requirements have been satisfied, approval was granted and the survey link was distributed to all the volunteers across all regions across England who matched the research's specified inclusion criteria. The online survey was carried out between the 26th of March 2021 and the 2nd of August 2021.

3.4.1 Ethical consideration

The following ethical considerations were observed, ethical clearance was obtained from the UWE ethics committee and the study was conducted in line with the BPS ethical guidelines. As such, participants' consent was sought before participation. Information Sheet, (see Appendix 12), which explained to the participant about the aims of the study and what was asked of them. It also contained information about the researchers' details, the purpose of the study, how the collected data would be stored and only used for the purpose of the study. The page required participants to provide consent by ticking a check box agreeing to the stated conditions before gaining access into the main survey. The information sheet also ensured the participants were aware that they did not have to take part in the study if they did not want to, could withdraw at any point, the information they gave would be anonymous and confidential and no harm would come to them for taking part. By ticking the consent form, they were agreeing they have read and understood the Information Sheet. They were informed of their voluntary participation and their rights to withdraw at any point during participation without consequences. They were also informed that their data would be kept confidential and anonymously and would only be used for the purpose of this study. A link was provided for the participants to read the data privacy policy. In addition, contact details were provided should the participants have questions regarding the study at the end of their participation and can be provided with the results from the study should they wish to.

To ensure compliance with the ethics and anonymity guidelines for the participants, the survey did not collect any personal identifiable information from the participants and the respondents' data were completely anonymised. Access to the survey data was securely stored on UWE's one drive which was password protected and only accessible to the researcher and the two supervisors. Data from online survey was downloaded and stored on a password protected and encrypted file on my 'Microsoft OneDrive for Business' account (UWE OneDrive) after which the paper survey data will be added at that point. Anonymised survey link was posted online and no identifiable information about the participants was requested. The survey data was stored in password protected encrypted Microsoft word document.

3.4.2 Offline recruitment

Paper surveys were made available to retirement living developments. A poster with research details was emailed to service managers of retirement living developments that were printed and displayed on the development's communal notice board. Interested individuals could request a printed version of the survey pack from the service manager. The survey pack contained an envelope, participant information sheet, consent form, privacy document and the survey document. The researcher made contact with the service managers of developments to provide them with the study details and the survey pack would be delivered to the development should there be any potential participants who were interested in taking part. The completed paper surveys were to be handed over to the service manager in a sealed envelope which the researcher would arrange for collection.

3.4.3 Online recruitment

The survey link was distributed to JDR research volunteers, and the link was also posted on social media platform i.e., Facebook page and LinkedIn, and WhatsApp social media platforms. In addition, participants were also recruited through snowballing by distributing the survey link on WhatsApp platform. The online link directed potential participants to a screening page which comprised of the person information sheet containing details about the survey. In addition, a privacy information form was also provided. The potential participants were required to answer some screening questions to ensure that they met the requirements of the targeted population. The questionnaire was structured in such a way that survey should not proceed if any of the required conditions are not fulfilled. The questionnaire inclusion criteria required all caregivers to be informal /unpaid, who were caring for individuals with dementia aged 65years and over. If the participants did not meet the inclusion criteria, the survey was linked to bring up finish page where the interested participants would be informed that they were not selected to participate and was thanked for their time. This ensured that only eligible participants had access to responding to the rest of the questionnaire. The eligible participants were then directed to a briefing page which contained information about the study. The information included the participants' voluntary participation, the purpose of the study, the maximum length of time it can take to complete the survey, information about anonymity, how data would be safely stored and only be used for the purpose of the study. The participants were required to indicate their informed consent before they could proceed. Once informed consent is obtained the participants will have access to the questionnaire.

3.4.4 Floor and ceiling effects

Floor and ceiling effects were explored by checking the frequencies to examine the proportion of scores that fell within the highest and lowest possible scores on the scales. Floor and ceiling effects are importantly viewed in psychometric evaluation as its presence would mean that the scale is unable to detect a change within constructs (McHorney & Tarlov, 1995). The floor effects were considered to be present if above 15% of respondents had the lowest possible scores, the ceiling effects were considered to be present if 15% of respondents had the highest possible scores on the scale (McHorney & Tarlov, 1995). There were no floor or ceiling effects present.

3.4.5 Missing data

There were no observed patterns in the missing data following the process of data imputation which was conducted. All missing data was completely random. As a rule of thumb according to Hair, Black, Babin, and Anderson (2010). and Anderson (2010), 0.4% to 10% range for missing responses per variable acceptable. Therefore, all the variables were within the acceptable range when data imputation was carried out.

3.4.6 Dichotomisation of variables

Some variables in this study were dichotomised namely; Technology Acceptance (IOU), Technology Access, and Sense of Competence, using a binary split at the median method. A binary split allows data to be categorised enabling comparisons of groups with high or low measurement values (Preacher, Rucker, MacCallum, & Nicewander, 2005). It greatly simplifies the statistical analysis, leading to an easy interpretation and presentation of the results. This dichotomisation process was considered appropriate to categorise the variables in this study due to the sample size. Another method of dichotomising variables is known as extreme group analysis which some have argued to provide an acceptable justification. This process requires selecting very high or very low scores on a variable and then only use these extremes in the study (Preacher et al., 2005). This is achieved by selecting the upper and lower quarters, but excludes the middle 50% of the distribution. The extreme ends are then categorised into high or low groups. While focusing on the extreme ends of the distribution has been argued to increase the differences in data samples and enhance the observed effects, it requires a much bigger sample size beyond the scope of this study. The sample size in this study was not large enough to split otherwise, it would have resulted in low statistical power as the sample size would not have been left with enough participants for the study to obtain a meaningful data presentation. It was important to ensure that the sample size left after the split was large enough to give statistical power hence the utilisation of the binary median split.

Dichotomisation variables can simplify statistical analysis, leading to easy interpretation and presentation of the results. However, the disadvantages raised are that information can be lost, and the statistical power to detect a relationship between the variables and outcome is reduced (Nuzzo, 2019).

The technology acceptance (IOU) variable was dichotomised using the median as the cut-off point. The values were categorised such that 0 being low intenders and 1 being high intenders. The median was 2.8241 and the values were categorised such that values less or equal to 2.8241 were low intenders and were assigned a value of 0. Those with over 2.8241 were high intenders and were assigned a value of 1.

Technology access which was rated on a scale (1=Definitely can to 5=Definitely) were transformed to the following; selections 1-2 were assigned a value 1 representing “Yes”; selections 4-5 were assigned a value of 2 representing “No”; and selection 3 was assigned a value of 0 representing “Uncertain”.

Sense of competence scale was dichotomised based on the median (22) of total scores ranging between 7 to 35 as the cut-off point. Total scores of 22 and above were assigned a value of 2 representing “Competent”, any total score of 21 and below were assigned a value of 1 representing “Not competent”.

CHAPTER FOUR

4. Study 2: Qualitative Investigation

This chapter addresses the qualitative investigation which sought to understand the attitudes of people living with dementia on memory aid devices. This forms part of the mixed method which involved presenting the participants with a digital memory calendar they had an opportunity to keep to experience how it functions as a type of memory aid.

4.1 Participants

A total of nine older adults living with dementia or undiagnosed memory issues referring to those with early or mild memory problems took part in the study. Participants were recruited from two retirement living developments within the region of Hertfordshire which comprised of apartments that could either be purchased or rented by adults aged 65years and over. The residents living within this community could choose to have additional paid services which included household tasks, care and other lifestyle support services. Participants were recruited who were aged 65 years or older who were diagnosed with dementia, and those with no formal diagnosis but showed signs of memory decline. These signs included regular forgetfulness of daily tasks such as forgetting to take medication, not keeping up with their daily tasks, forgetting to turn up for lunch in the restaurant, etc.

Following the recruitment of nine participants, it was felt that the point of data saturation was reached as no new information was gathered from the interviews (Guest, Bunce & Johnson 2006). Therefore, no further recruitment of participants from other developments was carried out. Qualitative data sampling is said to be purposive, and chosen based on its capacity to give richly-textured information appropriate to the phenomenon under investigation (Vasileiou, Barnett, Thorpe, & Young, 2018). Guest et al., (2006) suggested that data saturation could be attained by as little as six interviews. Sample sizes in qualitative research has been the subject of ongoing debates as it has been argued that qualitative research has no straightforward method to determine the appropriate sample sizes (Vasileiou et al., 2018). This is because study designs are different and there is no one size fits all method of data saturation, and determining the saturation levels differed from study design to study design. While it is acknowledged that data saturation fails to provide any pragmatic guidelines for when it has been reached, it has been argued that data saturation in studies is relevant. Guest et al., (2006) highlighted that the general principles of data saturation were based on having no new data, no new themes, no new coding, and the ability to replicate the study.

4.1.1 Recruitment process

The participants were recruited with the assistance of the service managers who worked at the developments for an average of five days per week. The manager was considered to be in a strong position to know the people who matched the study criteria, and would also be in a position to know those who could provide informed consent through their daily dealings with the residents. The participants were living independently in their flats except for one participant who lived with his spouse who was also his caregiver. The residents lived their lifestyles as they would in any residential communal setting, and these developments provided an opportunity to recruit target participants who matched the study criteria.

4.1.2 Inclusion criteria

Contact was made with the service manager through a phone call requesting for their assistance to help facilitate for the researcher to visit residents with dementia diagnosis or those who showed signs of MCI. The service manager's role involved daily checks of all residents' wellbeing and maintained the records. This meant that they could identify any changes in residents' health and wellbeing as they were seeing the residents more often than family members. Also, the service manager is the person the residents' family usually discuss with any dementia diagnosis or any identified concerns about the residents who might require care support needs. The manager was provided with information on the eligibility criteria:

- people who were 65years and over
- diagnosed with dementia or mild cognitive impairment
- those with undiagnosed memory problem (those with early/mild memory problems).
- living independently in their own homes,
- capable of providing consent for participation.

4.1.3 Screening

The service manager consulted with the residents who matched the eligibility criteria to offer them an opportunity to take part in the study. The total number of identified eligible participants were 23 however, only 9 people agreed to take part following the initial briefing of the study. The dementia severity rating scale (DSRS) was administered by the researcher with the assistance of the service manager during recruitment after the potential participants had agreed to take part. All the participants who took part were scored at mild levels according to the DSRS scoring as their scores did not exceed 18 out of the total possible score of 54. Though all the participants were given the opportunity to try the memory prompting digital calendar, only 4 out of 9 participants agreed to keep the device for illustrative purposes (Fig 4.3b). Those who refused to keep the device agreed to see a demonstration of its operation on the day when the researcher came to conduct the interviews. Therefore, all participants had an opportunity to experience how the memory prompting digital calendar worked before the interviews were performed.

4.4.1 Ethical considerations

Permission to recruit within the retirement living developments was sought and granted by the management company of the developments (Appendix 6), and the study was approved by the UWE ethics committee on 25 November 2020 (Appendix 12). The study was conducted in line with the BPS code of ethics guidelines. The participants were given the participants information sheets (appendix3), data privacy policy (Appendix 2) and consent forms (Appendix 4) and were given at least a week prior to taking part. This allowed the participants to have time to read through the details of the study and help them make informed decisions. It also enabled them to consult their families if they wished to before committing to taking part. They were provided with opportunities to ask any questions they had and seek clarity on what they didn't understand. The participants were also constantly reminded of their rights to withdraw from participating should they decide to at any point during the study. The consent forms were reviewed and signed at the beginning of the interviews. The participants were required to confirm their acceptance of the interview being audio recorded on the consent form. Participants were reminded they could withdraw from the research up until one month after interview. Due to the characteristics of participants which identified them into the vulnerable group due to age, careful ethical considerations were clearly set. Ethical concerns have been raised when recruiting people with dementia and MCI for research to ensure authentic and informed consent was obtained as there were possibilities of fluctuating consent (Dewing, 2007). To address this, the study utilised a rolling consent approach to obtain informed consent from participants. This approach required repeating information to participants at every stage of the study to ensure that that the participants fully understood. what they are consenting to. Therefore, information about the study was repeated and participants reminded of their rights to withdraw at any point should they wish to.

To ensure compliance with the ethics and anonymity guidelines for the respondents' data, a pass code protected smart phone was used to record the interviews. The recordings were transferred into a secure UWE drive storage and deleted from the smart phone immediately after each interview. Additionally, written notes of the interviews were kept securely locked away in a lockable locker only be accessed by the researcher. Audio files and other documents containing personal information about the participants fall under the Data Protection Act 2018 and were password protected to safeguard it against any unauthorised access. Careful consideration was taken into account to ensure the research complied with the data protection principles to keep participants data safe. Only information intended to be used in the study was collected and only used for the purpose of the study. The participants were reassured of the data privacy and there were no references of their names to identify them. Transcribed data was stored on a password protected personal computer with any identifiable participant. Information such as names and personal details stored separately from interview data.

Additional measures were implemented to ensure the protection of personal data which was achieved by creating a code for each participant i.e., the first letter of their name and develop a key code. However, the participant's name and code were stored in separate locations. This meant that any accidental unauthorised exposure of one data set would not enable information to be matched that would identify an individual. When analysing the data and writing up the analysis all participants' data was anonymised through the use of pseudonyms to protect the identities of the participants. Any identifiable printed information such as consent forms were stored in the researcher's office in a locked cabinet to which only the researcher had access to.

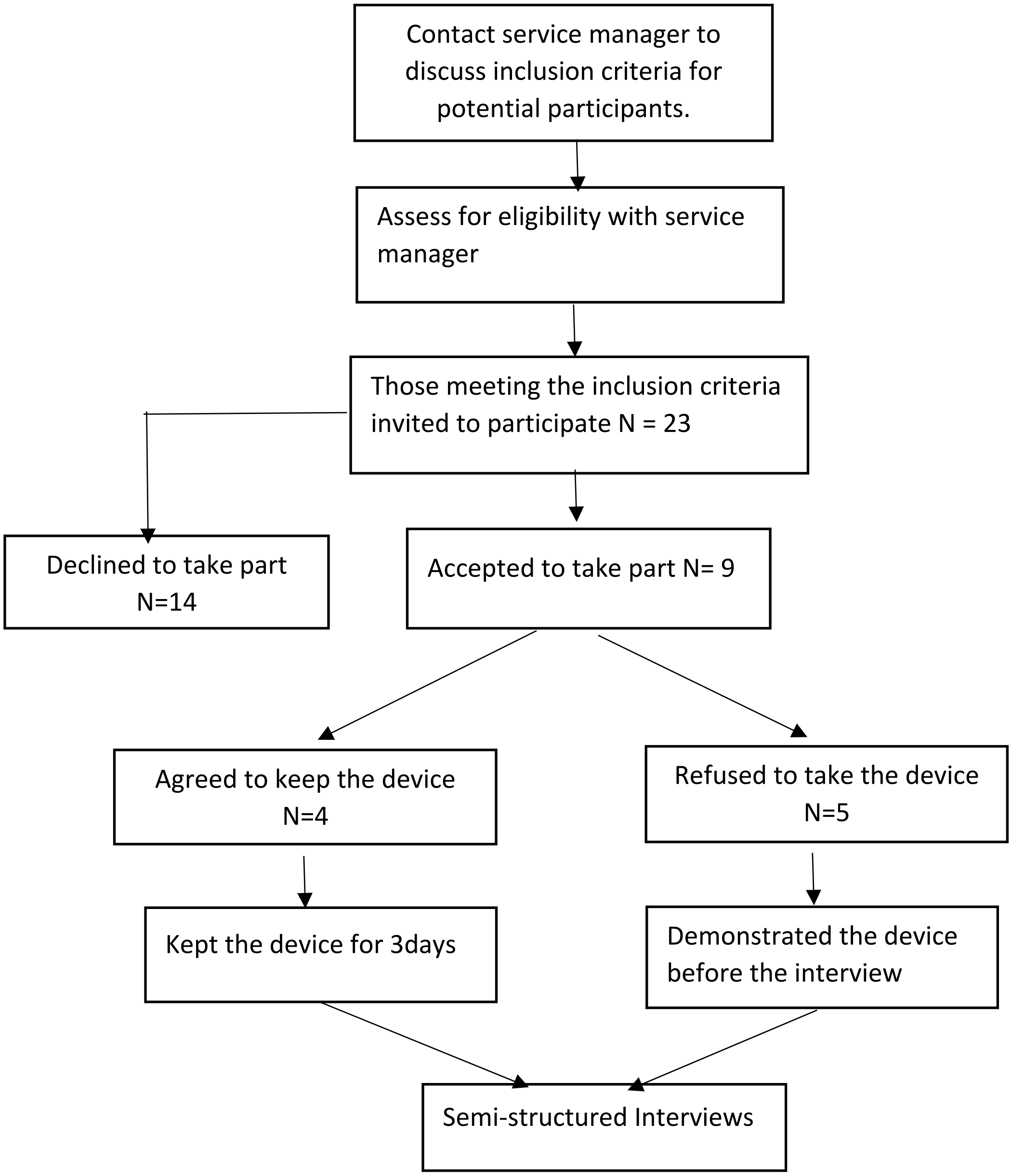

Fig 4.3b Consort Chart of participants recruitment procedures

The raw data produced from interviews was temporarily stored on a recording device on the researcher's password protected smart phone. Extra precautions were implemented for the data to be transferred swiftly to UWE OneDrive secured storage which would then be permanently deleted from the device. These were transcribed to create anonymised interview data/transcripts and the text was stored in word documents .doc/docx format. This data had all identifiable features removed and pseudonyms were created which had no link to the participants' information. All information held within OneDrive for Business was stored such that it was covered by data protection regulations. Data was stored on a password protected and encrypted file on my 'Microsoft OneDrive for Business' account (UWE OneDrive) provided by the University. The password was unique and known only to the researcher to prevent unauthorised access.

4.2 Materials

4.2.1 The dementia severity rating scale (DSRS)

DSRS is a brief, informant-based multiple-choice questionnaire that is used to quantify functional impairment in Alzheimer's disease. It assesses the severity from the mildest to the most severe stages in the major functional and cognitive domains affected in Alzheimer disease but provides a broader range of scores to detect progression of the disease across time. It is comparable in its ability to distinguish dementia from no-dementia and MCI. The advantage of using the DSRS is that the assessment can be conducted by a caregiver or self-administered and can be completed via mail, Internet, or phone. It only takes about 5minutes to administer and comprises 12 domains. The total score is out of 54 and the scoring interpretation required adding up the points for all sections; 0-18 --- Mild; 19-36 – Moderate; 37-54 – Severe (Appendix 1).

4.2.2 A touch screen memory prompting alarm calendar:

MemRabel memory prompting daily calendar clock is a type of memory aid technological device that assists people with dementia or memory problems in their daily tasks. This device can automatically play voice automated messages and reminders as programmed to assist with daily routines. The caregivers could help to set device up either directly or using a smartphone, and be configured remotely. The used alarms can be edited or deleted online to avoid any confusion. This device provided a good example of

MAT available specifically targeted for people with dementia to support individuals facing challenges in remembering to perform certain tasks on their own.

In addition, the device has over 100 pre-set typical daily reminder videos, voice memos and picture files covering medications, home safety, eating, drinking, diabetes, security etc. to help with important reminders, alarms and memory prompts. Another important feature on this device is it allows caregivers/family to create meaningful messages that act as memory prompts for the people they provide support to. This can be done via a smartphone app to set up alarm times and record and send personalised and meaningful videos, photos or text messages. Furthermore, the memory-prompting videos can help people remember daily routines, chores, appointments or medicine time reminders. For instance, a family member could set a reminder every day at 12pm telling the person with dementia to take their medication (see Fig 3.2b). This removes any feelings of worry that the person might forget their tablets and reduce their reliance on caregivers. The devices were loaned to the participants for three days as it gave them an opportunity to experience how a typical AT could help them by providing prompts to remember things. It also provided an opportunity to determine their attitudes towards AT and if it was worth considering to have.

A multimedia digital calendar alarm clock. It has a phone App to allow recording of videos, take pictures and send them to the device via the internet. The alarms can be personalised as audio, video, or picture reminders. They can be set to maintain a daily routine: breakfast, lunch, dinner, medication reminder, birthdays, doctors' appointment, carer visit reminders, play music, send text or video messages with phone app. Features include:

- *Clock with programmable reminder alarms*
- *Displays reminders in photo, video or audio form*
- *Alarms can be personalised for familiarity*
- *Timed playback of personalised video*
- *Touch screen alarm time memory prompt set up*
- *Plan a daily routine with video instruction*
- *Manage medication reminders*
- *Simplified alarm memory prompt set up wizard*
- *Hearing impaired visual alarm notification*

Hi Dad it's time for your lunchtime pills. We will phone you today at 6 O'Clock

Hi Mum

Your lunch is in the fridge in the box with the blue lid. Microwave on full power for 1 minute

I'll be round to see you after work

Love Jan

Fig 3.2b MemRabel 3 Touch Screen Memory Prompting Alarm Calendar

3.2.3 Self-designed qualitative interview

Semi-structured interviews were designed by the researcher and tailored to the aims of the study. This was designed to capture people's views and attitudes towards the digital memory calendar as a form of memory aid technology. This style of the interview asks specific questions in an open-ended way with optional suggested prompts and exploratory follow-ups. Therefore, it facilitated a flexible discussion on relevant topics providing in-depth insight into the why behind responses. In addition, it was informed by questions eliciting people's views about technology in general and their perceptions around it. The interview questions were open-ended questions based on TAM which aimed to capture participants' perceptions and attitudes towards the memory prompting digital calendar and to understand whether they thought MAT would improve their quality of life. The questions were structured to be simple, straightforward and avoid asking complex questions to make it easy to understand (see example of interview transcript: Appendix 14). Interview questions were refined following the piloting stage that was carried out before the main investigation. The following interview questions were only used as a guide but were simplified to suit the participants' communication preferences. The interviews were carried face to face in participants' homes.

- What are your opinions of using technology?
- How do you manage your daily routine?
- What do you use for reminders?
- What challenges would you anticipate to encounter when using similar device?
- What did you find useful about using this device?
- How easy do you think that this device would be to use?

3.2.4 Additional materials:

The following additional materials were used: Data privacy notice (Appendix 2), participant information sheet (Appendix 3) for the participants which provided them with full details of the study, qualitative consent form (Appendix 5) that the participants were required to be completed prior to taking. Additionally, masks and hand sanitisers for infection control. Permission to recruit participants from retirement living service (appendix 6), ethics clearance (appendix 12), Covid-19 risk assessment (appendix 15) which was used to ensure all covid-19 safety measures were followed. Covid-19 impact statement (see Appendix 17).

4.3 Pilot study

A pilot study was performed in order to evaluate the potential of the main research. Conducting a pilot study was considered an important process prior to conducting the main research because it helped to improve the study design (Thabane et al., 2010). It also enabled the researcher to better prepare to face the potential challenges likely to be faced in the main research as the potential participants were considered vulnerable. The trial run was conducted before the start of the Covid-19 era and before any restrictive measures were put in place. It involved three individuals who volunteered to participate who were over 70 years of age and living within the retirement living development. They were required to try out the process of the study. However, the participants were neither diagnosed with dementia nor had MCI, but it was considered that their views closely represented that of targeted participants within their age group. It was considered that their contribution would make a difference in the way that the study would be effectively carried out. The researcher invited interested volunteers during a regular coffee morning weekly gathering from the retirement development where the researcher worked. The interested individuals were then visited by the researcher who explained the purpose and process of the pilot study and their involvement. This pilot procedure was conducted as would the main research to establish how the participants viewed the whole process of the research. The volunteers were provided with the research materials which included the Participant Information Sheet, the Privacy Policy sheet and the consent form. They were required to sign the consent form prior to participating. The reminders on the memory digital calendar were set by the researcher according to the volunteers' specifications and they were left to keep the device for one week. After the end of one week the researcher visited the volunteers and conducted interviews. The volunteers were then asked to comment on the materials, their understanding on the information provided, the digital memory calendar, its performance and how they felt about the interview questions. They were encouraged to provide their honest views to ensure that information was clear and to acceptable standards. The findings from this pilot study revealed that having the digital device for a shorter time would be ideal because some individuals might end up losing interest if it was kept for long. This was evidenced from one volunteer who decided to switch the device off as she thought it was becoming a nuisance to her. Also, the volunteers highlighted that the topic on dementia was a sensitive issue which people avoided to talk about hence, it was imperative for the researcher to exercise caution during the discussions. Following the volunteers' comments, advice and contributions, adjustments were made on the research process. This pilot study helped to identify issues in design and helped to evaluate the practicality resources and time for the main research (Thabane et al., 2010). Furthermore, it helped to identify any flaws in the design procedures designed and helped to clarify ambiguities in the information provided to participants as well as identified the potential issues with the device.

4.4 Procedure

4.4.1 Covid-19 infection control measures

As this study was carried out during the covid-19 pandemic era, the recruitment was carried out at one retirement living development at a time to reduce the risk of over sampling as well as a covid-19 safety measure. This was conducted face to face in participants' own homes. Due to the covid-19 pandemic, the researcher paid careful consideration in ensuring the safety of the participants and that of the researcher. The researcher was flexible in adapting to effective infection control measures. This ensured that the research process was covid-19 proof as it was not possible to predict in advance what the government safety guidelines would be in place during the time of recruitment. The researcher ensured to constantly review the health and safety procedures and making adjustments according to the current government guidelines. In addition, the researcher maintained regular contact with the research supervisors for continued support and guidance. Furthermore, the researcher conducted pre-visit check prior to visiting any development to ensure that it was covid-19 free and also followed the risk assessment to protect the safety of the residents (Appendix 15).

Due to the vulnerability of the potential participants because of older age and increased susceptibility to poorer covid outcomes which resulted among the elderly, it was important for extra precautions to be taken. This was to ensure effective infection control measures were followed to reduce the risk of spreading infection. This meant using alternative ways of screening the participants in a safer way i.e., taking the temperature of the participants, having the participants answer covid screening questions.

4.4.2 The impact of Covid-19 on the study

As this research was carried out during the covid-19 pandemic period, there were some restrictions that impacted the research directly or indirectly (see Covid-19 Impact Statement: Appendix 17).

4.5 Researcher reflexivity

I bring substantial levels of knowledge and experience in working with older adults with dementia and those with unidentified cognitive problems. I am quite familiar with the typical challenges some people face, and how much effort they make to conceal their positions. This possibly is due to people living within retirement living development are aware that should any issues develop that threatens their safety and wellbeing, other measures might be implemented such as having a live-in carer living with them which might be expensive. Another alternative might be moving to residential care facilities where support will be provided to meet their needs. As people are aware of this, they do not want to move to care homes, and so they are under pressure to demonstrate that they are still capable of independent living.

During this period, I had been working in one of the developments as a service manager. Having the experience of working with older people with memory issues and dementia related challenges for over ten years, my approach to this research is from a constructivist point of view. I have knowledge of the impact of the importance of family support in older adults particularly when there are signs of memory issues, and the need to maintain independence in older population. Therefore, it was important to consider that my partiality might be impacted based on the knowledge and experience that I had acquired over the years in dealing with people with MCI and dementia. It was important for me to remain objective and constantly kept reflecting on my views and judgements during the process. To reduce this, I constantly met with my supervisors to discuss about my assumptions who questioned my interpretations and assumptions. It was also considered that my everyday dealings with the residents might make them feel pressurised to participate and respond in a way that would be desirable to the researcher resulting in conflict of interest. Therefore, I conducted my research out of my place of work. In order to minimise the likelihood of my own personal assumptions and bias influencing the research, I recruited participants from other developments, that way I would ensure to maintain my partiality towards my views. Having maintained regular supervisions with my two supervisors whose combined experience of dealing with quantitative and qualitative research as well as dealing with people with dementia helped me to keep me in check. In addition, I kept a reflective journal that helped me to self-evaluate my views and maintain my interpretations partial. My engagement in reflective process helped me to identify my assumptions and how they likely influenced the way I interpreted data.

CHAPTER FIVE

5 Quantitative Results

This quantitative part aimed to identify the factors that play a role in the acceptance of MAT for older people living with dementia, and to explain the role of caregivers in accessing and acceptance of memory aid technologies for the people they support. This was achieved by examining some frequency statistics on demographic characteristics to explore the factors at play a role on the acceptability of MAT; examining the role of income on technology accessibility; exploring the relationship between caregiver's sense of competence, perceived ease of use, perceived usefulness, and attitudes towards MAT acceptance; and the relationship between dementia severity, education, experience and age in relation to MAT acceptance for people with dementia. The sections 5.1 and 5.2 presents exploratory data analysis which is a visual exploration of data method which helped to summarise the characteristics of the data. This was to help to understand and analyse the data sets to give meaningful insights into the data.

A data analysis plan was structured as it was considered important to guide the step-by-step process and ensured that the important information was gathered (Banks, Paige & Mather, 2013). The data analysis plan helped to visualise the study outcomes and mainly comprised of dummy tables and figures that illustrated the qualitative investigation outcomes (Appendix 13).

The data was analysed using SPSS Statistics 28 software. Firstly, the descriptive statistics were examined to understand the composition and representativeness of the sample. This involved exploring demographic data on the caregivers and for people with dementia providing the frequencies and percentages of the variables. Table 1.4 shows the general characteristics of the caregivers and people with dementia relating to different aspects of support, details about the diagnosis, as well as information on technology use and access. This information was useful in understanding some variations in technology acceptance and access.

The next section comprises of data crosstabulation grouped by acceptance of MAT according to those who accepted MAT versus those who rejected MAT. This was to explore the variables that likely contribute to MAT acceptance in caregivers and their thoughts on what people with dementia might view MAT. The cross tabulations were based on sex (for both caregivers & people with dementia), age, experience with technology, dementia severity, caregiver sense of competence, education, type of dementia, technology possession, ethnicity. In addition, monthly income was grouped by technology access to understand statistical frequencies existing within the data. This was to explore the variations in technology access in respect to monthly income.

A multiple linear progression was carried out to explore the relationship between psychological factors which are; attitudes, perceived usefulness, perceived ease of use and caregiver sense of competence on technology acceptance. Furthermore, the relationship between technology acceptance and the following demographic factors: education, age, technology experience and dementia severity (CDR) was also explored using multiple linear regression analysis.

Table 5.1.3 illustrates the summary of the statistical frequencies of demographic information of the participants and the people they care for. Table 5.1.4 shows the characteristic data of care givers and the people they care for.

Tabel 5.1.3 *Demographic information for all respondents and the people*

		Caregiver		People with Dementia	
Variable		**N**	**%**	**N**	**%**
Total		119		119	
Gender	Male	16	13.4%	50	42%
	Female	102	85.7%	66	55.5%
	Non-binary / third gender	1	0.8%	1	0.8%
	Prefer not to say	0	0	2	1.7%
Source of recruitment	JDR	77	64.7%		
	Social media platform	12	10.1%		
	Prefer not to say	10	8.4%		
	Other	20	16.8%		
Relationship	Spouse / Partner	26	21.8%		
	Brother / Sister	2	1.7%		
	Parent	44	37%		
	Friend	1	0.8%		
	Other family	18	15.1%		
	Other	28	23.5%		
Ethnicity	White	87	73.1%		
	Mixed or Multiple ethnic groups	1	0.8%		
	Asian or Asian British	3	2.5%		
	Black, African, Caribbean or Black British	24	20.2%		
	Other ethnic group	4	3.4%		
Education	Secondary schooling level	-	-	4	3.4%
	Compulsory schooling	15	12.6%	54	45.4%
	College/technical/trade school training	29	24.4%	33	27.7%
	Some undergraduate degree	35	29.4%	12	10.1%
	Some postgraduate degree	40	33.6%	16	13.4%
Monthly household Income PCM	Less than £1500	8	6.7%		
	>£1500 > £3000	45	37.8%		
	>£3000 > £5000	30	25.2%		
	>£5000	13	10.9%		
	Don't know what to say	2	1.7%		
	Prefer not to say	21	17.6%		

Table 5.1.4 *Characteristic data of caregivers and people living with memory difficulties*

Variable		Caregiver		People with Dementia	
		N	%	N	%
Total		119		119	
Dementia Diagnosis	MCI			6	5%
	Alzheimer's disease			60	50.4%
	Vascular Dementia			28	23.5%
	Other type of dementia			15	12.6%
	Undiagnosed			10	8.4%
Degree of cognitive impairment	Questionable Cognitive Impairment			20	16.8%
	Mild dementia			59	49.6%
	Moderate Dementia			35	29.4%
	Severe dementia			5	4.2%
Technology possession	Yes			58	48.7%
	No			61	51.3%
Care Experience	Yes	44	37%		
	No	75	63%		
Average contact frequency	> 1 day per week	12	10.1%		
	1 to 2 days/week	14	11.8%		
	3 to4 days/week	26	21.8%		
	< 5 days per week	67	56.3%		
Length of support	0 to 6months	7	5.9%		
	6- 12months	13	10.9%		
	1-2years	22	18.5%		
	2-3years	29	24.4%		
	Over 4years	48	40.3%		
Technology Access	Definitely can			12	10.1%
	Probably can			18	15.1%
	Might or might not			17	14.3%
	Probably cannot			31	26.1%
	Definitely cannot			41	34.5%
Knowledge about MAT available (self-rating)	Extremely knowledgeable	13	10.9%		
	Very knowledgeable	30	25.2%		
	Moderately knowledgeable	41	34.5%		
	Slightly knowledgeable	15	12.6%		
	Not knowledgeable at all	20	16.8%		
Knowledge about where to access AT	Strongly agree	17	14.3%		
	Somewhat agree	47	39.5%		
	Neither agree/disagree	24	20.2%		
	Somewhat disagree	16	13.4%		
	Strongly disagree	15	12.6%		
Experience with Technology	High experience	53	44.5%	7	5.9%
	Moderate experience	44	38%	26	21.8%
	Experience	21	17.6%	24	20.2%
	Little experience	-	-	34	28.6%
	No experience at all	1	0.8%	28	23.5%

5.1 Description of demographic data

A total of 119 caregivers (102 females, 16 males, 1 non-binary) took part in the survey, (Age range 19 to 93, M =, 54.85, SD = 14.38). The people with dementia being cared for were also 119 (66 females, 50 males, 3 non-binary), age range 19 to 93, M = 81.87, SD = 8.29.

The statistics reveal that data was collected from respondents predominantly from white ethnic group, 73%. This was followed by 20% of the respondents from black ethnic group. Other ethnic groups had the least number of respondents.

The majority of the respondents 65%, were recruited from JDR volunteers whose characteristics matched the inclusion criteria of the study. Only 10% of the respondents were recruited from other social media platforms, 17% were recruited through other means (word of mouth, snowballing), and 8% of the respondents did not indicate where they were recruited from.

5.1.1 Educational levels attained by caregivers and people with dementia

The statistics highlighted that most of the caregivers were highly intellectual with 33.6% who had a postgraduate degree, 29.4% had an undergraduate degree, 24.4% had college training level and only 2.6% of the caregivers had completed education at mandatory schooling level. This suggested that education played a role in people's general use of technology.

However, most of people with dementia had compulsory schooling level (45.4%), 27.7% had college training, 13.4% had post graduate level, 10.1% had some undergraduate degree and 3.4% had no formal education.

5.1.2 Type of dementia diagnosed and severity

representation of dementia diagnosis for the people being cared for. The frequency statistics revealed that people with Alzheimer's disease were mostly cared for, 50.4%. This was followed by 23.5% who had vascular dementia, 12.6% had other type of dementia, 8.4% had undiagnosed memory problems and 5% had mild cognitive impairment.

The statistics revealed that 46% had mild dementia, 29.4% had moderate dementia, 16.8% had questionable cognitive impairment and 4.2% had severe dementia.

5.1.3 Caregiver relationship with the person they care for and their care experience

Most caregivers (63%) had no previous experience of providing support to anyone prior to caring for the people they support. Statistics revealed that most caregivers supported their parents 37%, with 21.8% caring for their spouses, 15% were caring for a family member and 23.5% indicated to be caring for other individuals.

5.1.4 Frequency of the care support provided and period of support

The statistics revealed that the majority of the caregivers had been providing support for over 2years. In addition, 56.3% caregivers provided care support for at least five days per week, 21.8% provided supported for 3 to 4 days per week, 11.8% supported 1 to 2 days per week and 10.1% less frequently. This reflected how most caregivers had long term commitment to provide support which suggests that there are certain aspects of their daily routines they had to give up in order to be available for support.

5.1.5 Monthly household income

The statistics revealed that most caregivers (37,8%) had a monthly combined monthly household income range of over £1500 but less than £3000, 25% had monthly income range over £3000 but less than £5000, Approximately 10.9% had monthly income of over £5000, 6.7% income less than £1500, and 19.3% did not disclose their income range. None income disclosure could have been that there might not be shared monthly income responsibilities between caregivers and the people they care for.

5.1.6 Access to memory aid technology

Most caregivers 60.6% (34.5% & 26.1%) indicated that the people they supported could not access MAT, and 25.2% (10.1% & 15.1%) indicated that they could access MAT. This is somehow contradictory as there is a substantial number of people with dementia already in possession of some type of technological device. It may well be that inability to access MAT was due to lack of interest in the memory aid technology type.

5.1.7 Caregivers' knowledge about where to access memory aid technology

Statistics revealed variations in response to having knowledge about where to access MAT. The statistics revealed that only 16.8% indicated not having any knowledge at all about where they could access MAT. The rest of caregivers had variations in the levels of knowledge they had i.e., 10.9%, 25.2%, 34.5%, 12.6%, 16.8%. This reflected that the majority of the caregivers had varying levels of knowledge of the type of assistive technology which could be used by people with dementia in support of their memory.

5.1.8 Caregivers' knowledge about the types of memory aid technology available

The statistical frequencies revealed that most caregivers had some level of knowledge about the types of MAT available 14.3% and 39.5%. Fewer caregivers indicated not having knowledge; 13.4% and 12.6%, and 20% indicated that they were uncertain.

5.1.9 Experience with technology

The caregivers had varying levels of experience in dealing with technology. This was no surprise considering the fact that all participants were recruited online. However, there was no compelling difference in having experience with technology for the people they cared for as 47% indicated that they had experience and 53% had little to no experience.

5.2 Crosstabulation of data frequencies in respect of MAT acceptance

Statistical frequencies were explored in respect to MAT acceptance across different variables. Table 1.5 shows frequency statistics of caregivers' age who indicated their views about MAT acceptance for the people they cared for. As seen, MAT was mostly accepted by older caregivers whose age ranged between 50-65years (63.7%) and mostly rejected by younger caregivers whose age ranged between 18-29years (100%), and 30-49years (66.7%). However, there was no significant difference in MAT acceptance for those aged over 65years. The chi-squared test of association which was performed to further explore the differences revealed that there was a significant relationship between different age groups and technology acceptance, X^2 (3, N=119) = 15.975, p = .001 (see Appendix 18: Table 1.5.1). The post hoc analysis revealed that age range 18-29 and 50-65years significantly differed, and 30-49 and 50-65 significantly differed from each other (table 1.5.2).

Table 1.5 *Frequencies of caregivers' age in respect to technology acceptance*

	MAT Acceptance	
Caregiver Age	**Reject (%)**	**Accept (%)**
18-29years	6(100)	0(0)
30-49years	24(66.7)	12(33.3)
50-65years	16(32.7)	33(67.3)
Over 65years	15(53.6)	13(46.4)

Table 1.5.2 Post Hoc Comparisons – Caregivers' Age

		Mean Difference	SE	t	p_{tukey}
(18-29years)	(30-49years)	-0.799	0.564	-1.416	0.492
	(50-65years)	-1.704	0.553	-3.080	0.014
	Over 65years	-1.393	0.575	-2.421	0.079
(30-49years)	(50-65years)	-0.905	0.281	-3.225	0.009
	Over 65years	-0.594	0.322	-1.844	0.258
(50-65years)	Over 65years	0.311	0.303	1.027	0.734

Table 1.6 shows caregivers' experience with technology in respect to MAT acceptance. The statistics revealed that 52.4% of the caregivers with moderate experience in technology accepted MAT while 47.6% rejected it. Of those with high experience in technology, 48.5% accepted MAT while 51.5% rejected it. The Chi-Squared test highlighted that there was no significant difference between technology acceptance and the level of experience with technology X^2 (2, N=119) = 1.065, p = 0.587 (Appendix 18: Table 1.6.1). This reflected that there was no association between experience with technology and MAT acceptance, and that people's levels of experience did not affect their acceptance of MAT. While this may be so, it is imperative to highlight that people with dementia and caregivers had some type of technological devices, it may well be that people were not interested in memory aid kind of technology.

Table 1.6 *Showing frequencies of caregivers' experience with technology in respect to technology acceptance*

	MAT Acceptance	
Experience Level	**Reject (%)**	**Accept (%)**
Moderate	10(47.6)	11(52.4)
High Experience	50(51.5)	47(48.5)

No Experience	1(100)	0

Table 1.7 below reveals statistics of the people who accepted MAT in respect to dementia severity. A higher proportion of caregivers providing support to people with questionable cognitive impairment and mild dementia rejected MAT while a higher proportion of those caring for people with moderate and severe dementia accepted MAT. This revealed that caregivers who support people with higher severe symptoms accepted MAT more than those will lesser severe symptoms. This suggested that the caregivers might be looking for alternatives to ease the pressures and demands on supporting people and would accept MAT to reduce the level of responsibilities of caring. The chi-squared test showed that there was an association between dementia severity and MAT acceptance X^2 (3, N=119) = 19.230, p = < .001 (Appendix 18: Table 1.7.1). This meant that more caregivers of people with moderate to severe dementia accepted MAT and more caregivers of people with mild or undiagnosed memory issues rejected MAT. The post hoc test revealed that there was a significant difference between questionable cognitive impairment and moderate levels of dementia, and mild level of dementia and moderate levels of dementia (table 1.7.2).

Table 1.7

Frequencies of dementia severity in respect to acceptance of technology

	MAT Acceptance	
Dementia Severity	**Reject (%)**	**Accept (%)**
Questionable cognitive impairment	15(75)	5(25)
Mild dementia	36(61)	23(39)

Frequencies of dementia severity in respect to acceptance of technology

	MAT Acceptance	
Dementia Severity	**Reject (%)**	**Accept (%)**
Moderate dementia	10(28.6)	25(71.4)
Severe dementia	0(0)	5(100)

Table 1.7.2 Post Hoc Comparisons – Dementia Level

		Mean Difference	**SE**	**t**	**p_{tukey}**
Questionable cognitive impairment	Mild dementia	-0.358	0.320	-1.120	0.678
	Moderate dementia	-1.345	0.346	-3.884	< .001
	Severe dementia	-2.038	0.618	-3.299	0.007
Mild dementia	Moderate dementia	-0.987	0.264	-3.744	0.002
	Severe dementia	-1.680	0.575	-2.919	0.022
Moderate dementia	Severe dementia	-0.693	0.591	-1.173	0.645

Table 1.8 shows frequencies of dementia diagnosis in respect to MAT acceptance; 16.7% had MCI, 55% had Alzheimer's disease, 39.3% had vascular dementia, 53.3% had other types of dementia and 50% had memory problems but undiagnosed. The chi-squared test showed that there was no association between technology acceptance and the type of diagnosis (4, N=119) = 4.546, p = 0.337 (Appendix 18: Table

1.8.1). This reflected that the type of diagnosis did not play a role on whether or not people accepted MAT.

Table 1.8 Frequencies of type of dementia in view of MAT acceptance

	MAT Acceptance	
Diagnosis	**Reject (%)**	**Accept (%)**
Mild Cognitive Impairment	5(83.3)	1(16.7)
Alzheimer's disease	27(45)	33(55)
Vascular Dementia	17(60.7)	11(39.3)
Other type of dementia	7(46.7)	8(53.3)
Undiagnosed but has problems with memory	5(50)	5(50)

Table 1.9 shows data for caregivers' sense of competence when providing support to the people they care for. The statistics revealed that those who felt not competent, 51.5% would accept MAT while 48.5% would reject it and 47.7% of those who felt competent would accept MAT while 52.3% would reject it. The Chi-Square showed that there was no significant difference in the caregiver's sense of competence to providing support in respect to technology acceptance (1, N=119) = 0.141, p = 0.707 (Appendix 18: Table 1.9.1). This reflected that there was no association between caregivers' sense of competence in effectively providing support and MAT acceptance.

Table 1.9 Frequencies of the caregiver's sense of competence in respect to technology acceptance

	MAT Acceptance	
Sense Of Competence	**Reject (%)**	**Accept (%)**
Not Competent	16(48.5)	17(51.5)
Competent	45(52.3)	41(47.7)

Table 1.10 shows frequencies of MAT acceptance based on caregivers' education levels. Those who were highly educated accepted MAT more than those who had college training and compulsory training levels. Those educated to post graduate degree level 52.5% accepted MAT, and those educated to undergraduate level 54.3% accepted AT. Those educated to college/technical/trade level 37.9% accepted MAT and those educated up to compulsory school level 46.7% accepted MAT. However, chi-squared revealed that there was no significant association (3, N=119) = 2.039, p = 0.564 (Appendix 18: Table 1.10.1), between educational levels and MAT acceptance. This reflected that caregivers' educational levels did not determine acceptance of MAT.

Table 1.10 Frequencies of the caregiver's education level in respect to technology acceptance

	MAT Acceptance	
Caregivers' Education	**Reject (%)**	**Accept (%)**
Compulsory schooling level	8(53.3)	7(46.7)
College/technical/trade	18(62.1)	11(37.9)

Table 1.10 Frequencies of the caregiver's education level in respect to technology acceptance

	MAT Acceptance	
Caregivers' Education	**Reject (%)**	**Accept (%)**
Some undergraduate degree level	16(45.7)	19(54.3)
Some postgraduate degree level	19(47.5)	21(52.5)

Table 1.11 below shows data in relation to ethnicity and the statistics revealed that more caregivers from white ethnicity accepted MAT, 59.8% while fewer rejected MAT, 40.2%. More caregivers from black ethnic background rejected MAT 83.3%, while fewer accepted MAT 16.7%. The Chi-Squared showed that there was a significant association between ethnicity and MAT acceptance (4, N=119) = 16.257, p = 0.003 (Appendix 18: Table 1.11.1). This suggested that ethnicity had a role to play in MAT acceptance as statistics revealed that proportionally, more people from black ethnic background rejected MAT whereas, more people from white ethnic background accepted MAT.

Table 1.11 Showing frequencies of ethnicity in respect to technology acceptance

	MAT Acceptance	
Caregiver ethnicity	**Reject (%)**	**Accept (%)**
White	35(40.2)	52(59.8)
Mixed or Multiple ethnic groups	1(100)	0
Asian or Asian British	2(66.7)	1(33.3)
Black, African, Caribbean or Black British	20(83.3)	4(16.7)
Other ethnic group	3(75)	1(25)

Table 1.12 shows that more male caregivers accepted technology than females. Of the 16 male caregivers who took part, 62.5% accepted MAT, and of the 102 female caregivers, 46% accepted MAT. However, there was no significant relationship between caregivers' gender and MAT acceptance as the chi-squared revealed X^2 (2, N=119) = 2.553, p = 0.279 (Appendix 18: Table 1.12.1).

Table 1.12 Frequencies of caregivers' gender in respect to MAT acceptance

	MAT Acceptance	
Caregiver Gender	**Reject**	**Accept**
Male	6(37.5)	10(62.5)
Female	55(53.9)	47(46.1)

Table 1.13 revealed that the caregivers indicated that 48% men would accept MAT, and 51.5% of women would accept MAT. However, the chi-squared test showed that there was no relationship between the gender of people with dementia and MAT acceptance, X^2 (3, N=119) = 3.067, p = 0.381 (Appendix 18: Table 1.13.1). This suggested that the caregivers did not show differences in their opinion as to whether they thought the gender of the people they cared for played a role in MAT acceptance.

Tables 1.13 Frequencies of people with dementia's gender in respect to MAT acceptance

	MAT Acceptance	
Gender	**Reject (%)**	**Accept (%)**

Tables 1.13 Frequencies of people with dementia's gender in respect to MAT acceptance

	MAT Acceptance	
Gender	**Reject (%)**	**Accept (%)**
Male	26(52)	24(48)
Female	32(48.5)	34(51.5)

5.3 Hypothesis Testing

Hypothesis testing involved two analysis methods. To test hypothesis 1 and hypothesis 2 involved analysing the association of variables in relation to MAT acceptance using chi-squared test of association. This revealed the association which existed between the variables. Hypothesis 3 through to hypothesis 10 was tested using multi-linear regression analysis to test if the predictor variables (attitudes, perceived usefulness, perceived ease of use, caregiver competence, caregiver age, education, technology experience, dementia severity) would predict MAT acceptance. This was to establish if there were significant relationships between the variables that predicted MAT acceptance.

5.3.1 Monthly household income and MAT access

Hypothesis 1: stated that there will be a positive relationship between higher monthly household income levels and MAT access. This hypothesis was not supported as the chi-squared showed that there was no significant association between different income ranges and technology access, X^2 (5, 119) = 4.822, p = 0.438 (Table 1.14.1). This means that the amount of income did not make much of a difference in whether people could access MAT or not. This contradicted the literature which stated that people with higher income had greater access to MAT than those from low-income households. This suggested that income was not relevant in the accessibility of memory aid technologies. Table 1.14 below highlights frequency statistics of monthly household income in respect to technology access.

Table 1.14 Frequencies of monthly household income in respect to MAT access

	Technology Access	
Income	**Yes (%)**	**No (%)**
Less than £1500	0%	7(87.5)
Over £1500 but less than £3000	13(28.9)	26(57.8)
Over £3000 but less than £5000	9(30)	16(53.3)
Over £5000	4(30.7)	8(61.5)

Table 1.15 Showing frequencies of people with dementia technology possession in respect to technology acceptance

	Technology Acceptance	
Technology Possession	**Reject (%)**	**Accept (%)**
Yes	38(65.5)	20(34.5)
No	23(37.7)	38(62.3)

5.3.2 Technology possession and MAT acceptance

Hypothesis 2: stated that there will be a positive relationship between greater technology possession and MAT acceptance. The chi-squared test revealed that there was a significant association between technology possession and MAT acceptance, X^2 (1, 119) = 9.205, p = 0.002 as shown in Table 1.15.1. The statistics showed that, 65.5% who possessed technology rejected MAT while 62.3% without technology accepted MAT (see table 1.115. This means that more people who possessed some kind of technology rejected MAT and more people who did not possess any kind of technology accepted MAT, thus rejecting the hypothesis. While this was not expected as people in possession of technology were assumed would accept MAT due to familiarity, it may well be that people were not willing to engage in memory aid technologies. People might be using the technology in their possession for other things but not prepared to use the memory aid features that can be found in some technological devices. This reflected that people who already possessed some technologies were not interested in MAT.

Regression analysis one

To prepare for the regression analysis to determine the relationship between the dependent variable, MAT acceptance (IOU) and the independent variables PU, PEOU, ATT and SCQ, data was screened for assumptions and outliers, and no outliers were found. All assumptions of linearity, normality, and homoscedasticity were found to have been met, and no multicollinearity was present (Table 2.3).

The results indicated that the overall model significantly predicted MAT Acceptance, F (4,113) = 127.983, $p<.001$ explaining approximately 82% of the variance (R^2 = .819). All variables significantly predicted acceptance of memory aid technology, PU: β = .264, t (113) = 3.623, $p< .001$; PEOU β = .422, t (113) = 6.059, $p < .001$; ATT β = .387, t (113) = 5.763, $p < .001$, SCQ β = -.024, t (113) = -2.471, p = .015. The tables include the model summary (Table 2.1), ANOVA table (Table 2.2), and coefficient table (Table 2.3).

Table 2.1

Model Summary - IOU

					Durbin-Watson		
Model	**R**	**R^2**	**Adjusted R^2**	**RMSE**	**Autocorrelation**	**Statistic**	**p**
H_0	0.000	0.000	0.000	1.354	-0.009	1.980	0.914
H_1	0.905	0.819	0.813	0.586	0.082	1.827	0.336

Table 2.2

ANOVA

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
H_1	Regression	175.699	4	43.925	127.983	< .001
	Residual	38.782	113	0.343		
	Total	214.481	117			

Table 2.3

Coefficients

							Collinearity Statistics	
Model		**Unstandardized**	**Standard Error**	**Standardized**	**t**	**p**	**Tolerance**	**VIF**
H_0	(Intercept)	3.013	0.125		24.171	< .001		
H_1	(Intercept)	0.226	0.286		0.789	0.432		
	PU	0.264	0.073	0.242	3.623	< .001	0.360	2.778
	PEOU	0.422	0.070	0.379	6.059	< .001	0.409	2.447
	ATT	0.387	0.067	0.384	5.763	< .001	0.360	2.777
	SCQ	-0.024	0.010	-0.101	-2.471	0.015	0.961	1.041

5.3.3 Attitudes and MAT acceptance

Hypothesis 3: stated that greater levels attitudes towards MAT would significantly predict MAT acceptance. The hypothesis was confirmed which revealed that attitudes significantly predicted technology acceptance, ATT $\beta=.387$, $t(113) = 5.763$, $p<.001$ (see table 2.3). This showed that there was a significant relationship between attitudes towards MAT and its acceptance i.e., when people have a positive attitude towards MAT they are more likely to accept it than when they have negative attitudes. This was in line with the previous studies which suggest that people's attitudes towards technology is related to technology acceptance. The results were based on caregivers' views of people they support as whether they thought they would accept technology. As caregivers often play a significant role in supporting people with dementia through introducing and encouraging them to MAT, they are more likely to have opinions that closely represent that of the people they support. Caregivers are actively involved in looking for ways to outsource the support they provide, and literature shows that they might be motivated to look for alternative means to ease the level of support they provide.

5.3.4 Perceived usefulness and MAT acceptance

Hypothesis 4: stated that greater levels of perceived usefulness would significantly predict MAT acceptance. This was as expected as the results showed that perceived usefulness significantly predicted MAT acceptance, $\beta=.264$, $t(113) =3.623$, $p<.001$ (see table 2.3). This means that there was a significant relationship between caregivers' perceptions of MAT usefulness and their acceptance of MAT. This is in line with literature that suggests that when people perceived certain types of technologies to be useful, they were likely to accept it. However, acceptance of technology might vary according to the type of technologies referred to. For instance, some might perceive other types of technological devices to be more useful for certain activities such as video conferencing, games etc than others.

5.3.5 Perceived ease of use and MAT acceptance

Hypothesis 5: stated that greater levels of perceived ease of use would significantly predict MAT acceptance. As hypothesised, perceived ease of use significantly predicted MAT acceptance, PEOU β=.422, t (113) =6.059, p<.001 (see table 2.3). This also supports the technology acceptance model and other literature which suggested that when people perceive certain types of technology to be easy to use, not requiring much effort, they are likely to accept it. Literature has shown that people are likely to adopt to using new technology if they felt they were no complications involved in using it. As descriptive data has revealed (table 1.6), that most caregivers have some form of experience of using technologies, they are more likely to have confidence in supporting people with dementia to use technology which can play a role in how easy they perceive MAT to use.

5.3.6 Caregiver sense of competence and MAT acceptance

Hypothesis 6: stated that lower levels of caregiver sense of competence would significantly predict MAT acceptance. As hypothesised, caregiver's sense of competence significantly predicted MAT acceptance, β=-.024, t (113) = -2.471, p=.015 (see table 2.3). This means that there is a significant relationship between caregivers' sense of competence in supporting the people they care for and technology acceptance. When caregivers felt competent in the way they provide care for the people they support, they might not see the need to outsource other ways of providing additional support. However, when they feel less competent in their role, they might be motivated to accept MAT to compensate for other areas they feel lacking, and also to ease the pressure of caring for their loved ones.

Regression analysis two

Another multiple regression analysis was performed to predict technology acceptance based on participant education level, participant age, technology experience and dementia severity. The results indicated that the overall model statistically significantly predicted technology acceptance. The overall model predicted approximately 21% of variance in IOU, $R^2 = .211$, $F(4,114) = 7.631$, $p = <.001$ explaining 21% of the variance ($R^2 = .211$). Participant's age significantly predicted MAT acceptance; $\beta = .331$, $t(114) = 2.431$, $p=.017$; and dementia severity significantly predicted MAT acceptance $\beta =.145$, $t(114) = 4.521$, $p < .001$. However, education and experience were not significant predictors; $\beta =.036$, $t(114) = .330$, $p=.724$; $\beta=-.068$, $t(114) = -.234$, $p = .815$. The tables include the model summary (Table 3.1), ANOVA table (Table 3.2), and coefficient table (Table 3.3).

Table 3.1 Model Summary - IOU

					Durbin-Watson		
Model	**R**	**R^2**	**Adjusted R^2**	**RMSE**	**Autocorrelation**	**Statistic**	**p**
H_0	0.000	0.000	0.000	1.351	0.003	1.958	0.815
H_1	0.460	0.211	0.184	1.221	-0.046	2.066	0.716

Table 3.2 ANOVA

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
H_1	Regression	45.506	4	11.376	7.631	< .001
	Residual	169.942	114	1.491		
	Total	215.447	118			

Table 3.3

Coefficients

							Collinearity Statistics	
Model		**Unstandardized**	**Standard Error**	**Standardized**	**t**	**p**	**Tolerance**	**VIF**
H_0	(Intercept)	3.021	0.124		24.389	< .001		
H_1	(Intercept)	0.853	0.660		1.292	0.199		
	P Age	0.331	0.136	0.207	2.431	0.017	0.953	1.049
	P Education	0.036	0.110	0.028	0.330	0.742	0.982	1.018
	Experience	-0.068	0.289	-0.020	-0.234	0.815	0.958	1.044
	Severity	0.145	0.032	0.381	4.521	< .001	0.976	1.025

5.6.7 Age and MAT acceptance.

Hypothesis 7: stated that more younger caregivers would be positively associated with MAT acceptance. The results revealed that caregivers' age significantly predicted of MAT acceptance, β= .331, t (114) = 2.431, p=.017 (see table 3.3). This means that there is a significant relationship between caregivers' age and technology acceptance. This supported the literature that there was a relationship between age and technology acceptance. However, the results revealed that older caregivers accepted MAT more than younger caregivers (see table 1.5). It may well be that there are specific types of technologies that are more acceptable to younger age groups than MAT. The high level of acceptance of MAT in caregivers aged 50-65years suggested that older caregivers might view the significance of MAT as this is also the age group with the highest number of caregivers (see table 1.5) who provide support to people with dementia than the rest of the age groups. High acceptance levels in this age group might be driven from the realisation of the need to outsource additional memory aid support to ease the responsibilities they have based on their experience.

5.6.8 Education and MAT acceptance.

Hypothesis 8: stated that higher levels of education would be positively associated with MAT acceptance. The hypothesis was not supported as higher education levels did not significantly predict technology acceptance, β=.036, t (114) =.330, p=.724 (see table 3.3). This means that there was no significant relationship between education level and technology acceptance. This was not expected as literature showed that that higher education has been said to positively influence people's perceptions on technology. It may well be due to the fact that almost all caregivers were educated to some levels thereby not having difference to influence the results.

5.6.9 Experience with technology and MAT acceptance.

Hypothesis 9: stated that greater levels of experience with technology would be positively associated with MAT acceptance. The hypothesis was not supported as technology experience did not significantly predict MAT acceptance, β=-.068, t (114) =-.234, p=.815 (see table 3.3). This means that there was no significant relationship between MAT acceptance and experience with technology. This contradicted literature which stated that people with prior experience with technology were more likely to accept MAT than those without. This may well be that though people might have experience in certain technologies, they might not be interested in some types of technologies or may find no need to have it. Other people also might have experience with technology perhaps at work but may not be interested to own one for their personal use. This revealed that having experience in technology does not warrant that MAT would be accepted.

5.6.10 Dementia severity and MAT acceptance

Hypothesis 10*:* stated that higher levels of dementia severity would be positively associated with MAT acceptance. As predicted, dementia severity significantly predicted MAT acceptance, *β= .331,* t (114) = 2.431, p=.017 (see table 3.3). This means that there was a significant relationship between greater levels of dementia severity and MAT acceptance. This supports the literature which suggested that caregivers are motivated to outsource the support with hopes to reduce the consistent need to be reminding the people they care for. However, as dementia progresses, people might no longer be able to comprehend even the instructions from the device. Therefore, they are more likely to be open minded when it comes to assistive technologies. Perhaps added responsibilities would cause caregivers of those with more severe dementia to accept MAT than those still low to mild levels due to the low level of support they need.

5.4 Summarising the quantitative results

The quantitative investigation revealed that TAM reliably predicted MAT acceptance thus supporting previous studies. The results showed that people were ready to accept MAT based on their attitudes when they perceived it as being useful and easy to use. In addition, some socio-demographic factors played a role in MAT acceptance but not all as anticipated. For instance, factors such as dementia severity which revealed higher MAT acceptance for caregivers looking after people with greater symptoms, and older caregivers accepted MAT more than younger caregivers. This suggested that those with greater caring responsibilities were motivated to seek additional ways to support the people they cared for than those with lesser responsibilities, and that older caregivers had greater caring responsibilities. This revealed that people were driven towards MAT acceptance by need. Then there were other factors which revealed unexpected results such as technology possession, experience with technology, and monthly income that showed no significant association with MAT acceptance. This suggested that there were other important factors at play that required further exploration.

CHAPTER SIX

6.1 Qualitative Results

The aim of this qualitative study was to identify recurring patterns or themes around how people living with dementia or those with cognitive problems of unidentified nature make sense of memory aid technologies. The participants were recruited from retirement living developments where older adults aged 65 years and older, living independently in their own apartments.

Table 6.2 Summary of participants' demographic details (Participants' names are pseudonyms and other identifying details have been changed)

Name	*Age (Yrs.)*	*Sex*	*Occupation*	*Education Level*	*Diagnosis*	*Kept the device for 3 days*
Bob Morris	90	Male	Draughtsman	College	Cognitive difficulties of unknown cause	No
Daniel Larson	86	Male	Teacher	Degree	Parkinson's dementia	Yes
Doreen Parks	78	Female	Secretary	Diploma	MCI	Yes
Gerald Reed (had a caregiver present with him)	79	Male	Factory worker	High school	Cognitive difficulties of unknown cause	No
Ed Murray	91	Male	Healthcare worker	Degree	Alzheimer's Disease	No
Nick Povey	88	Male	Engineer	Degree	Cognitive difficulties of unknown cause	No
Betty Martins	89	Female	Nurse	Degree	Mild dementia	Yes
Paula Grey	88	Female	Secretary	Mandatory school	Mild dementia	No
Portia Stevens	86	Female	Public servant	College diploma	MCI	Yes

The sample comprised of four women and five men aged between 78 and 91years who either had a diagnosis of dementia or had undiagnosed cognitive problems of unidentified nature. They were presented with an opportunity to experience how a digital memory aid calendar worked which is designed for people with dementia and MCI. A total of four participants, were happy to keep the device for 3days and five participants decided to have it demonstrated how it worked rather than keep it. This was then followed by interviews and the data was analysed using thematic analysis.

6.2 Data analysis: Thematic Analysis

Thematic analysis is a process of analysing the raw data collected within a qualitative research method. The process of thematic analysis enables the researcher to organise the data set and analyse it effectively in order to expose trends and other inferences in line with the research topic. The thematic analysis method can be used when seeking to understand a set of experiences, thoughts, or behaviours across a set of data (Braun and Clarke 2012). It is designed to search for common or shared meanings and involves looking across the data set to identify, analyse and report repeated patterns. Though it is a way of describing data, it also involves data interpretation during the selection of codes and the construction of the themes. Kiger and Varpio (2020) argued that the decision to thematic analysis should be based on the goals of the research, more than a desire to select an easy-to-follow method of analysis. Thematic analysis is known to give the researcher greater flexibility in to which themes are identified, it is important to identify themes that provide important insights which address the research question (Braun & Clarke 2006).

Braun and Clarke (2006) proposed six steps to conduct thematic analysis which guided this qualitative analysis. The first step involved familiarizing with the data. The purpose of this step was to get familiar with the data which began during data transcription from the audio data. Though the process was time consuming, it was considered important as it helped the researcher to become familiar with the data. The data set was then repeatedly read while taking some notes on interesting points which helped in getting to know the data set and engage analytically with the data, raising questions which helped to unpack meanings from the data. During the process, the researcher sought to understand what the data meant, what assumptions underpinned the accounts captured, why participants make sense of their experiences in that way, how would the researcher have felt in this situation, and what kind of world is revealed through this account. After familiarising with data, the researcher sought to identify the main features of the data which led to generating the initial codes. This involved writing notes, labels and highlighting interesting concepts in different colours. This was done by the assistance of NVIVO software to generate codes by highlighting data extracts with codes, taking into consideration patterns between items heading towards to the development of themes according to the data appropriate for the research question. Once the initial codes were generated, the researcher followed the next step searching for themes. This step involved taking a closer look at the codes and extracts that lead to identification of potential themes and patterns in data. The themes were constructed by the researcher through analysing, combining and comparing codes and using graphs to establish how codes are interrelated, placing data in different categories according to themes. After the potential themes were identifies, they were reviewed. This process involved refining the themes over and over, discarding and restarting themes while making improvements to ensure that the process was going in line with the research objectives. This helped to develop the themes that were appropriate which sufficiently answered the research question. Following this step next step required defining and naming themes. After the themes were confirmed, it was important to write brief definitions for each theme as this helped to categorise data more effectively into individual themes. This process was important as it helped to establish boundaries and differences within the data and avoid it being mis-represented. After the themes have been defined, the final step was to bring everything together. This was done through carefully studying the data categories while making observations and inferences. According to King (2004), the final report should move beyond mere description of codes and themes. Instead, the report should weave a narrative that provides a clear, concise, and logical account not only how a researcher interprets the data, but also clarifies the reason of the importance of the selected themes (Braun and Clarke 2006, 2012). Table 6.1 below summarises the theme generated from the interview data.

Table 6.1: Summary of themes

MAIN THEMES	SUB-THEMES
Self-preservation of dignity	- Being the subject of community gossip - People not coming in the open with memory issues - “Your memory is not that good”
Past the age of learning (*You can’t teach old dogs new tricks*)	- “I’m sure they are very useful to a younger generation” - “I’m in such a routine that you can’t really forget”
Attitudes towards memory aid technologies	- “I’m willing to learn and look at interesting things that appeal to me” - “I got to make myself think and remember” - “Who would need one of those” - “I’m not a particularly technological person”

6.2.1 Theme 1: Self-preservation of dignity

The participants in this study lived within their retirement living community where they had established social connections with other residents through different social activities such as coffee mornings, quiz nights, movie night, exercise classes etc. This provided them with a platform for them to regularly meet. It was felt that this kind of connection facilitated for other residents to recognise any unusual behaviours from other residents which raised residents’ suspicions about cognitive issues that they gossiped about. As this is a community resided people over 65 years, cases of dementia and other cognitive issues were expected to be more prevalent than in residential settings with younger population groups. During the interviews, there was a sense of the need to preserve dignity and self-worth from most participants. This seemed to be of great importance as participants did not openly disclose their situation. This theme comprised of three sub-themes which highlighted the extent to which participants valued other residents' views about them and how dementia was generally viewed within the community.

6.2.1.1 Being the subject of community gossip

The participants implied that other residents had a tendency to gossip about those residents they suspected to have MCI or dementia. The manner in which the suspected residents were gossiped about within the community reflected that this was not a subject that was openly discussed. This highlighted that this kind of gossip could be viewed by residents with dementia as diminishing especially when one had knowledge that the community would be talking about them in the same manner as they gossiped about others. Therefore, a safe way to preserve their dignity and avoid being the subject of discussion was not disclosing their condition to other residents.

> **A1:** "You often heard from the various conversations you pick up with time that oh you know he or she is very forgetful now and even forgets to take her daily tablets." Bob (line 21-23)

> **A2:** "I think a lot of people cannot or will not admit that they are losing their marbles. I genuinely think that. And it's not everybody but there are quite a few here who are obviously deteriorating. "Paula (line 57-58)

As evidenced in extract A2, the participant here reported that the residents with seeming cognitive issues did not want to admit about their challenges with memory but highlighted that other residents had a tendency to scrutinise the movements and behaviours of those individuals they suspected. She acknowledged that the residents with cognitive issues within the community did not want to admit the challenges they were facing to other residents to the extent where it became obvious to other residents (extract, A2). This seemed to be a sensitive subject that even the participant did not talk about her personal challenges resulting from memory dysfunction.

> **A3:** "I'm sure it would be helpful to them but I'm not sure how easy they would find if they have already lost quite a lot of uuum… there's quite a lot of people I can think of here who are very vague." Povey (line 36-38)

> **A4:** "I'm a bit pathetic but you know my memory is not as good as it used to be". Paula (line 21)

The manner in which participants referenced some people they were suspicious about for instance, "vague" as seen in extract A3 revealed other residents' attitudes towards some symptoms of dementia they observed from those affected. Additionally, personal internalised stigmatisation was revealed in the manner which one participant called herself "pathetic" due to the decline in her memory as shown in extract A4. Though one way of interpreting this statement is that it reflected a positive transition from this participant towards admitting her condition. However, another way is it reflected her attitude towards her condition and the way in which she felt she was viewed by other residents.

The participants seemed interested in talking about other people's situations and their views on how they might be incapable of dealing with technology without talking about their personal struggles (extract A5). This suggested that people might have established ways of protecting themselves from being scrutinised by other residents though drawing attention to the residents who showed signs of dementia and MCI.

> **A5:** “we sat with one block, the block he said that he doesn’t sort of know what’s going on really. I said why are you coming to the garden party he said I don’t know that sort of thing. People like that you know they might I don’t know whether they would be able to understand technologies…..” Povey (line 38-41).

> **A6:** “I’m a bit hesitate there because I think it puts a demand on an individual who is already handicapped with their memory problems”. Bob (line 19-21).

The manner in which one participant spoken other residents with dementia for instance, ‘people like that’ (extract A5), reflected that people felt the need to conceal their situation from the public as they might think that people would also talk about them in the same manner. This suggested that people with dementia were living on the edge trying to prove to other residents that their memory was still intact so as not to raise other people’s suspicions thus raising concerns of social labelling. Furthermore, the use of the term ‘handicapped’ (extract A6) revealed one participant’s views of the way people with dementia were seen as disabled, incompetent and unable to learn new things. In addition to this participant’s statement might be possibly interpreted that the participant was referring his personal concerns that his brain might no longer be capable of dealing with technology demands but lacked confidence to do so directly.

6.2.1.2 People not coming in the open with memory issues

Most participants did not openly disclose their situation, the few who did spoke indirectly about dementia. It was interesting to note how the participants avoided using the word dementia but instead used other phrases such as having a “let-down in mentality” or “recall” as seen in extract A8 and A9. This was interpreted that the subject on dementia/MCI was a sensitive issue which no one wanted to talk about. Within this community, people seemed to want to protect themselves and avoid being viewed as incapable of living independently. Due to the nature of the community, they resided, it may well be that people feared going to care homes should they be viewed as no longer capable of living safely on their own.

> **A8**: "…. since I've been here and I'm relaxed than before uuum you know I find that my recall is improving." Portia (line 51-52)
>
> **A10:** "I just think generally speaking people don't really want to admit it" Paula (line 60-61)
>
> **A7**: "I think really there is a place for technology in a lot of older people's life but a lot of them are scared of it and they would be unwilling to have any there." Doreen (line 61-62)

For instance, extract A7 revealed how one participant acknowledged the potential that memory aid technology had in compensating for memory loss but, reported that people unwilling to have it. This could have been that having the device would be admitting having cognitive dysfunction. One participant reported how her refusal to use memory aid support was upsetting her family (extract A9). This reflected that she understood the impact of her condition on her family and suggested feelings of guilt and shame but revealed how she was caught up between trying to comply with her caregivers' advice and trying to conceal her situation from other residents. This reflected some pressures which were encountered by people with dementia/MCI of concealing their situation from other residents who could potentially support them manage other activities.

A9: "I have some little boxes, which say Monday, Tuesday… which say take these in the morning …. and I experience something of a let-down in my mentality because whereas I was pretty sure of myself, I just suddenly was confronted with the fact that I was letting my family down the way I was behaving." Portia (line 45-48)

A11: "Yes, I do, because when you can't remember things, you perhaps have a reduced quality of life and maybe it bothers that you can't remember …. "Doreen (line 52-53)

It almost felt like it was a taboo talking about dementia and it seemed that people were living in fear of talking about their personal struggles. For instance, one participant spoke figuratively about people's worries about cognitive issues and perceptions on reduced their quality of life (extract A11). The way the participant spoke could possibly be interpreted that she was referring to her personal challenges and worries while avoiding to expose herself. This suggested that she felt the need to preserve her dignity and protect herself from public scrutiny which revealed some barriers people faced that hindered people from openly talking about their condition.

A12: "I think it could be very useful to someone who may have memory problems." Doreen (line 24)

A13: "I think for someone who would forget to keep a diary like a paper diary or forget to get things, that could be very useful, yeah I do." Doreen (line 27)

> **A14:** "… but there are a lot of people unfortunate some are dead now, but that would have been very helpful to them. And I do think certain people would be." Paula (line 40-41)

Extracts, A12, A13 and A14 revealed that the participants acknowledged the usefulness of memory aid technologies however, they did not admit that they needed it but instead reported that other people would find it useful. Through admitting the usefulness of memory aid technologies suggested that they positively perceived these types of technologies, it seemed that the other residents' views of people with dementia community had facilitated for barriers which influenced the acceptance of AT. These insights suggested the reasons why people would do whatever they could to conceal their situation in order to preserve their social position i.e., the way people in their community view them, otherwise they will end up losing their social position in the community.

6.2.1.3 "Your memory is not that good"

Not having a good memory might have been interpreted as losing one's dignity as for example one participant reported that she was pathetic for no longer having a good memory (extract A4). Here one participant lived with his carer openly admitted and was transparent about his challenges in the presence of his caregiver who was his wife (extract A17). The caregiver also spoke unreservedly about the challenges her husband faced due to memory issues. This reflected the manner in which people with dementia were open to discuss about their situation with the people they trusted, and that caregivers provided a safety net which the participants felt to have their loved ones support them without risking being talked about within the community. Having their loved ones possess technology would help them manage for instance, their social inclusion through connecting with family and friends online, managing finance etc which would reduce the need to constantly depend on them:

> **A17:** "I've got him now to book his appointment online uuum but your memory is not that good (my memory is terrible) every time he does it, he can't remember what to do so I have to prompt him the whole time (caregiver)." Gerald's caregiver (line 57-59)

> **A15:** "My grandson they bought me one and my daughters bought me one, and I call him Mr M, he came around set it all up and time. And occasionally I've had problems and would ask for him." Povey (line 16-17)

> **A16:** "yes, I suppose you might set it up for them, maybe. I mean I'm talking set it up for them and I mean my grandson certainly set it up for me, set it up for them and explain to them and they practise it, maybe they then those are the things they might be able to use it for." Povey (line 46-48)

The participants commonly spoke about the significance of caregivers in making technological devices accessible for them as well supporting them in setting up the devices and updating it (extract A15, A16). This suggested that the participants were willing to be vulnerable to those who they trusted, mostly their caregivers who they knew would not expose them to other residents within the community. This highlighted the important role the caregivers played in supporting their loved ones in areas they struggled as well as the attitudes towards AT. This suggested that the caregivers might be motivated to encourage technology acceptance and provide additional support with technology as a way to outsource their own copping.

6.2.2 THEME 2: Past the age of learning (You can’t teach old dogs new tricks)

This theme highlighted a proverb that implied that people are often unwilling to change their long-held habits. Advanced age was implicated as one reason for lack of interest in accepting AT. Most participants highlighted that technology was not meant for people in advanced age and that they did not see the point of engaging in new technologies now. They reported that they felt alienated from technologies as they were not dispositioned to it earlier. These views were commonly expressed despite the contradictory evidence that most of the participants had in their possession other types of technologies which they frequently used for different things. Therefore, the participants felt that they could use older age as the reason for declining memory aid technology. By using this reason reflected having an awareness of the risk of dementia with older age and people would not be pressured into adopting MAT they did not want anything to do with.

6.2.2.1 “I’m sure they are very useful to a younger generation”

Some participants highlighted that technology was mainly for younger generations who were still capable of learning and could easily navigate their way around different types of technologies (extract B10, B1, B3, B5). Using age as a barrier to learning new technology could be interpreted that that people were fearful of their cognitive capability that they might not be competent to learn which could expose their situation.

> **B10:** “The thing is, I’m 80 the end of the year, what do I want now who do I want to know now you know which is a wrong attitude I know.” Gerald (line 63-65)

> **B1:** "And I'm just not confident in myself. I think my age might come into it and take away my confidence on that." Portia (line 72-73)

> **B3:** "I'm sure they are very useful to a younger generation but I don't think that they particularly that useful to us." Betty (line 46-47)

> **B5:** "I think you need to start when you are in your 20s or 30s really…. to get going so that when you are getting older it's much easier." Betty (line 59-60).

The lack of interest suggested that these memory aid technologies were being viewed to represent a constant reminder of their condition and having this kind of technology might expose them to other members of the community. Therefore, they implied lacking confidence in dealing with new technologies due to lack of exposure and experience.

> **B4:** "Well, I think the younger generation are growing up using it where as we've learned a different way to live and we've got to change completely." Betty (line 50-51)

> **B2:** "I don't think they expect people in my age to have any background in it …possibly I don't know." Portia (line 88)

> **B8:** "I think older people are frightened of it. We probably retired when we was just getting into computers and a lot of people obviously 80 and over never saw a computer." Gerald (line 2-3)

The extracts above B4, B2 and B8 revealed that age was used as a reason to decline memory aid technology. This suggested that people were concerned of their brain's incapability to learn new information rather that the reasons expressed. On the other hand, it reflected a subtle way of honouring their condition but at the same time politely declining their need to use memory aid device. People seemed to be aware of the effects of dementia they might have observed in other residents whose condition deteriorated to the extent of losing spatial awareness.

6.2.2.2 "I'm in such a routine that you can't really forget"

Nearly all participants indicated that they established other coping strategies, therefore they did not see the need to use memory aid technologies for themselves. There was much reference of intrinsic routines which they religiously followed but did not mention about issues they had in remembering other aspects of their daily activities. The participants indicated that there was no need for them to change their ways of managing their daily routines they already had in place, all participants heavily relied on diaries.

> **B15:** "Usually, with the diary here that I keep on my coffee table I note all significant dates in it ... if I have maybe something happening tomorrow, I might write a little note here and put it there." Doreen (line 15-16)

> **B17:** "We'll you can't forget, well that's not entirely true we all have an odd day and we can forget something of course, but generally speaking I'm in such a routine that you can't really forget its instilled in you, it's for life." Bob (line 11-13)

> **B20:** "The daily ones, I think my routine is already established so I don't they are going to change that much." Daniel (line 19-20)

However, people chose to adopt to other familiar routines to try to manage their daily activities than admitting the device specifically developed to help with memory issues. This suggested that people felt that they were acknowledging their challenges with memory thus placing them within the category of those who were seen as incompetent.

> **B21:** "The only thing I can only say is I'll never mistake my medication, it's a question of routine, isn't it? And at the moment I'm able to cope with things." Povey (line 28-29)
>
> **B22:** "To be honest I'm so got used that diary over there, I'll like to keep my routine now maybe one day then it would be useful but I would like to stick the routine I've got because it works you know." Povey (line 31-32)
>
> **B23:** "I usually write them in my diary or write them on a piece of paper. And before I go to bed if I got anything special, I write it and put it there and look over it again and again." Betty (line 17-18)
>
> **B24:** "I do have a diary and I write you know what I'm gonna be doing the next day in the diary. urm I don't usually forget what I'm doing if its written for instance going out for lunch…. I do remember that." Paula (line 42-43)

The participants emphasised that they did not have problems remembering their established routines because they had successfully followed it for many years (extract B17, B21). Strong statements were made for instance in line 28-29 which revealed that the participant did not see the likeliness that he might forget at some point and would need prompting. The participants demonstrated how they had developed strategies to remember which they effectively used. All these reasons were interpreted as a way of being dismissive and lack of interest for memory aid devices from the participants suggested that people viewed it as a marker of dementia. More so, people had established alternative ways to cope with their daily routines and help to compensate for their memory which was less obvious to other residents than having technological device that revealed their challenges with memory. Though some people stated that memory aid technologies could only be used at a later time when one would no longer manage on their own without being prompted, the overall perspective from this was it was unlikely they would have it for their use. Lack of awareness of the disease that it progresses to the extent of having the individual need prompting.

6.2.3 THEME 3: Attitudes towards memory aid technologies

This theme represented how memory aid technologies were viewed. Some participants felt that memory aid technology was useful to some extent but not useful enough to contribute to their quality of life. They had views that these types of technologies were appropriate for people who had advanced cognitive issues and no longer capable of remembering their daily routines. However, what became apparent is that people had positive attitudes towards other types of technology such as internet banking, smart watch, Alexa, smart TV etc. which they already had in their possession. Also, technology seemed to be useful for them for different functions rather than as memory aid. This suggested that they had adjusted their lifestyles according to what was available at the time i.e., the use of diaries. This suggested that nothing could take the place of the diaries systems they had made into a lifestyle.

6.2.3.1 “I’m willing to learn and look at interesting things that appeal to me”

This sub-theme highlighted that people were willing to put in effort to learn what they viewed relevant. Most interviewees owned at least one technological device which they used for different tasks and activities. This revealed that these types of technologies were found useful and appealing, hence their adaptation. However, the lack of interest in memory aid technology reflected their negative attitudes towards it reflecting their views which they did not openly admit. People were willing to engage in other devices that appealed to them and what made them seem clever.

> **C1:** "I honestly don't know; I'm not going to sit down and write books and things I like but I'm always willing to learn and look at interesting things that appeal to me." Betty (line 82-83)
>
> **C2:** "started a long time ago because I was keen, because I thought it would improve my life give me some entertainment and very useful and it has been to be quite honest. I mean without it here I don't say I couldn't do without it but I would miss out a lot and its very convenient and it saves I wouldn't say it save me money not necessarily but it might do." Doreen (line 71-74)
>
> **C3**: "No I only got an ordinary phone and not a smart phone I've got a tablet, it's a kindle fire I've had it originally to use for reading books but it does all sorts of things I mean I use it for the emails and things of that sort." Daniel (line 9-11)

On the other hand, memory aid technology was perceived not contributing to quality of life therefore people felt that it might be useful for others but not them. People accepted technologies that they felt were useful to them and had some significance in their daily living activities.

> **C4:** “It would be helpful. To say to change your quality of life is probably a bit too far. It would in certain areas …certainly in the areas that I’ve mentioned it would certainly be helpful.” Daniel (line 32-33)

> **C5:** “I mean if there is real need, I would go at it. But I don’t see the real need at the moment particularly when they are all using that sort of phone.” Daniel (line 44-46)

Only one individual admitted to using a reminding feature on her tablet. However, she felt that it was important to emphasise that she was not reliant on using it. This brought up questions about her reason for the need to emphasis her point as she had spoken about it after the researcher prompted her as she had mentioned it prior to the interview. The possible interpretation of this was that admitting to using her timer was admitting memory problems which is a subject that was not openly discussed within the community.

> **C6:** “only the timer basically, I use it for the timer… I don’t really and its usually for something cooking, or dryer, uuuh I don’t usually use it for any reminders….” Doreen (line 21-22)

The lack of interest in memory aid technology reflected underlying psychological factors influencing their behaviour towards memory aid technologies. In addition, people spoke with pride about their interest and competences in their use of other types of technologies such as entertainment, gaming, information, banking etc. This suggested that they were willing to make an effort towards what they felt added value to their self-image and reputation within the community than memory aid which represented a decline in cognitive abilities and made them vulnerable.

> **C7: “**Well, I haven an iPad, and have a computer, on the iPad I can do email and social media stuff like that. On the computer I do shopping, banking, word document, emails, stuff like that basically.” Doreen (line 12-13)
>
> **C8:** “I use it to play on, I do all sorts of things I do quizzes and all sorts of things. Calling my seven grandchildren and my great grandchildren.” Betty (line 32-33)
>
> **C9:** “I use it for the sports results or I’ll be looking at the weather focus. If I want any information anything at all you can get everything there, these are the reasons I use it you know.” Povey (line 9-10)
>
> **C10:** “I don’t understand all the workings you know the apps this and that but I’ve just learned to scan and I have also learnt to send report that I get from a company to a chap that helps with my finances. I can do that email.” Paula (line16-18)

What this revealed is that people were willing to accept and make effort in learning what they were interested in and what they perceived to preserve their reputation with other residents. Though they admitted that memory aid technology was useful in some way, the participants did not show any interest. Perhaps their perspective of memory aid technologies could be different elsewhere within a community where people knew they would stay regardless of their situation. However, their community seemed to play a role in their views and attitudes. People felt it better to invest their time and effort and talk about the technologies that made them feel clever and were willing to learn regardless of how challenging it might seem.

6.2.3.2 “I got to make myself think and remember”

People valued their independence and revealed motivation in maintaining their independence. Some participants felt that having memory aid technology resulted in technology taking over their capability to think for themselves, thus taking their independence away. This reflected people’s perceptions of what reminding technologies represented and the effect it had of taking over one’s ability to remain in control of their life. People highlighted how important it was for them to remain doing as much for themselves as possible. When people referred to giving away their independent thinking capability to technology, people perceived it as having the potential to take over people’s thinking capability as well as manage their daily schedules. This reveals the extent to which people are misinformed about what memory aid technologies represent and why people were reluctant in accepting memory aid technology. For instance, the following quotes comments to expressed her views:

> **C11:** “I might well do, but at the moment I got to make myself think and remember otherwise I would just go downhill.” Betty (line 78-79)

> **C13:** “But then you don’t use own your brain, you don’t try to remember really. You rely on the clock all the time.” Betty (line 69-70)

C14:"Most probably to me in not-too-distant future but I do know when to eat my breakfast when I want to eat my breakfast." Paula (line 48-49)

C15: "so in a way it's a wonderful thing and I'd say actually tech is going to help the ageing more for those who are demented in particular anything that can help them recall I don't know how much you can do for someone who is really demented" Ed (line 81-83)

Other participants felt that MAT was for people who were at certain stages of dementia or for those who had significant memory loss and others felt it might be useful to them perhaps later on. Paula placed emphasis on how she was still capable of doing things on her own and highlighted why she felt she did not require AT.

6.2.3.3 "Who would need one of those"

Most participants did not show much interest in the device. Their comments when referring to the device reflected a dislike of this type of technology. They emphasised that they were not willing to consider the possibility of wanting to use it in future. This suggested that the acceptance of memory aid technologies implied that they were admitting their struggles to cope on their own. Consequently, this dislike was directed towards the MAT in particular but not other types of technologies. It was observed that people felt the need to demonstrate how well they were managing independently without any memory aid device consequently revealing that there was no place for it.

C16: "No… to be honest, I don't need that because I've got sort of routine, I've got a diary for my appointments which I look at every day and my medication I always take some after breakfast and one after lunch and I do it sort of everyday and I never…." Povey (line 21-23)

> **C17:** “I doubt whether any mechanical or technical backup is really going to change that because in my view only likely to complicate the person’s mental awareness.” Bob (line 23-25)

> **C18:** “Who would need one of those, now when you get to about 50 or 60 you begin to lose your eyesight, your hearing and your ability to walk from room to room, so I don’t know where you would put a thing like that.” Betty (line 1-2)

Participants revealed that they would rather carry on using their current ways of managing their daily tasks than use AT. The way in which some participants spoke about the device reflected a negative attitude towards MAT and revealed an unlikeliness of the possibility to use it in future. They used words such as ‘that’ referring to the device as seen in comment (C18) for instance; “I don’t need that” or “where you would put a thing like that….”. Referring to MAT in this manner reflected how memory aid technology was viewed which signified that they wanted to distance themselves from it. When people spoke about memory aid technologies it seemed to evoke some negative emotions which represents cognitive challenges associated with dementia and old age. Which could mean incapability of looking after themselves.

> **C19:** “If I need, if I got to the point that the way that I’m operating now was no longer adequate yes of course but at the moment I’d rather carry on with the way I am.” Povey (line 53-54)

> **C20:** “No, I got to be able to do things for myself as long as I can so I would make the most use of them if I could,” Betty (line 25-26)

The comment made in (C20) revealed that memory aid technologies were perceived to be for old people who are less independent and no longer capable of managing on their own. The participants’ statements and the manner in which they referred to the memory aid device reflected their lack of interest in the device. This could be possibly interpreted that it served as a constant reminder of their cognitive challenges which could cause them to be viewed no longer capable of looking after themselves which could be self-diminishing.

> **C22:** “I’m a bit hesitate there because I think it puts a demand on an individual who is already handicapped with their memory problems. To deal with another additional item to remember is probably overloading it.” Bob (line 19-21)

> **C24:** ”I certainly want to get up in the morning without the least amount of incumbrance that I could possibly find. And it’s not being lazy minded, it’s just peace of mind that I need now because I’ve worked all my life” Bob (line 73-75)

Though memory aid technologies are meant to reduce the cognitive demands on individuals, they were viewed as intrusive, disruptive and added additional burden. Additional burden here seemed to represent the weight it carried in respect to its being associated with dementia particularly for people who are already facing the challenges associated with memory loss. People with cognitive issues were viewed to have limited capacity to learn and understand what the memory aid technology represented. Using memory aid technology was negatively viewed as adding additional problems to someone who was already struggling to cope with the daily routines. Though people reported memory aid technology was useful to some extent, there was an understanding of its limitation to people with advanced memory issues.

6.2.3.4 “I’m not a particularly technological person.”

Some participants considered themselves as lacking the intelligence to deal with the memory aid technology in particular. They highlighted how they felt that technology was difficult to deal with especially with regular updates that require people to keep up with. Therefore, they stated that they could not keep up with the demands of having to continuously learn whenever there are new updates which was viewed as burdensome. This suggested that people were worried to approach technology for fear of being incapable of comprehending and grasping new information due to their cognitive impairments.

> **B6:** “I’m not a particularly technological person at all.” Daniel (line 11)

> **B7:** “I’m not clever you know with sort of the latest technology.” Paula (line 35)

> **B8:** “Well technology to be truthful is too clever for me and I’m not the person to sit down and study and try and find it.” Gerald (line 94)

> **B9:** “some people just don’t want to know about it and are frightened of it.” Doreen (line 59)

As seen from above extracts i.e., B9, B10 and B11, people stated different reasons for their reluctance to engage with memory aid device such as being lazy to learn, not clever enough, lacking a technical mind or being afraid to use technology. Though participants raised these reasons, it was in contradiction to the fact that eight out of nine participants were in possession of different technological devices. Moreover, some participants engaged with technology activities on other devices which required more effort and were more difficult than the memory aid device in question. While this may well be, this possibly interpreted that these reasons were stated out of politeness in rejection of AT. It was based on this interpretation that issues of social desirability were implicated in their responses.

> **B13**: “We’re also a bit nervous of pressing buttons in case we muck things up and we’ve go nowhere to turn to. Whereas the youngsters they will press the buttons explore.” Gerald (line 9-10)

> **B14:** “I know I’m not the first world’s technician when it comes to electronics because there was an advent which took place pretty much after my initial retirement.” Bob (line 33-34)

> **B15:** “I think the problem is the people of my age would find it quite difficult to reconcile themselves to understand the technology.” Povey (line 2-3)

The participants’ seemed to hold back their honest opinions about memory aid technologies in their responses (extract B14, B15). This was reflected in the simplicity of the memory aid device introduced to them which require little to no effort to set it up, yet they implicated perceived challenges which they assumed with the AT. It seemed that the general assumption was that technology would present challenges for older people who might not be able to understand it due to possible cognitive deterioration that was a possibility within that age category. Therefore, emphasis on categorising age such as: ‘people of my age’ as seen from extract B15.

6.3 Summary of the qualitative findings

Memory aid technology was viewed useful but the participants were reluctant to admit their need to use it. Open discussions about cognitive issues and dementia was avoided and people sought alternative ways to make up for their memory issues than having a device labelled for people with dementia. The community which people lived seemed to influenced people’s attitudes towards memory aid technology. The issue did not seem to be with the device itself but what it represented. People were worried about dementia, how people viewed others with dementia that resulted in people not openly discussing. Caregivers played a role in people’s attitudes towards MAT but challenging for people within this kind of community whereby people wanted to prove that their memory was still intact.

The findings suggested that the participants did not accept MAT for fears that other residents might gossip about how they were relying on memory support because they were no longer capable of coping on their own. This was considered in the way the participants gave reasons their lack of interest in MAT which seemed to be a plausible reason when in actual fact they did not want to be associated with it. People were willing to admit and talk about their condition in places where they felt safe. The participants regarded MAT useful but would not admit their need to use it as memory aid which showed that people lived with the pressure of concealing their condition. The community in which the people were based played a role and determine the attitude towards memory aid technology. As the participants were living independently within a retirement living community, they were aware that they might move to a care home should their condition deteriorated and no longer capable of living safely independently.

People with memory problems can rely on other people or on static reminders or cues such as written notes or diaries, to support their memory. However, what this study revealed is the memory prompting calendar seemed stigmatising that they did not accept it for use. Some participants highlighted that they were not willing to change their old habits and wanted to continue doing what they had been doing for a long time. MAT devices can help them to remember meaningful events, previous daytime activities which can help them to get by more independently. However, when the devices developed to help them to achieve this is not acceptable, measures need to be implemented to find the best way to successfully deploy AT. This could require their involvement in the design process and understanding their views when they see devices of such kind.

CHAPTER SEVEN

7 Discussion section

This study sought to understand the role played by different factors towards acceptance of Memory Aid Technologies (MAT), first to understand caregivers’ attitudes towards MAT, second to determine their roles towards the acceptance of MAT for the people they care for, third to understand the attitudes of older adults living with dementia and MCI. In order to gain insight into this, a mixed research method was carried out which utilised the quantitative and the qualitative approach. This chapter will discuss the research findings beginning by summarising the findings from each research approach. This will be followed by discussing the research question in relation to the hypothesis by integrating the findings from the two approaches and the interpretation of the results to answer the research question.

7.1 Quantitative findings

The quantitative investigation supported the notion of the Technology Acceptance Model, which suggested that perceived ease of use and perceived usefulness are essential factors as they contribute to people’s attitudes towards MAT acceptance. The regression analysis results confirmed this (see Table 2.3), which was in line with other studies which suggested that people most likely accepted MAT when they perceived it to be useful and easy to use. Additionally, the caregiver's sense of competence, dementia severity and age significantly predicted MAT acceptance in support of the hypotheses. However, higher education, technology possession and experience did not significantly predict MAT acceptance, and income was not significantly related to MAT access.

Furthermore, the results revealed that most of the caregivers had attained high levels of education, with most of them educated to the post-graduate level. This suggested that education played a role in their openness to technology. Most people cared for had mild dementia, and the most common type was

Alzheimer's disease. The caregivers mainly provided support for over five days per week and had been caring for over four years. This revealed the extent to which caregivers were involved in caring for their loved ones and had been providing support for a considerable length of time. The caregivers mostly cared for their parents and had no previous experience in providing care. The reported household income mostly ranged between £1500 to £5000 per month. However, most caregivers indicated that the people they cared for most likely could not access MAT, but this was not linked to their income levels. The caregivers reported having different levels of knowledge about where they could access MAT, and most knew the different types of technologies available.

Furthermore, almost all caregivers had experience dealing with technology, but the people they cared for had different experience levels. There was a difference in MAT acceptance by ethnicity as most participants were predominantly from the white ethnic background. A more significant proportion of people from white ethnic backgrounds accepted MAT, while more participants from black ethnic backgrounds rejected MAT. These differences suggested that ethnicity played a role in how MAT was viewed and accepted within marginalised communities, which may require further exploration.

7.2 Qualitative findings

The qualitative investigation comprised nine participants with dementia and MCI living in retirement settings. The study involved presenting a memory prompting calendar to people with dementia and MCI. This was to demonstrate to the participants how the calendar could operate as a memory aid. The demonstration was then followed by interviews which sought to understand their views and attitudes towards the device. The data was analysed inductively using thematic analysis. The qualitative investigation identified three main themes; the first was ‘Self-preservation of dignity’; The participants reported that having MAT almost openly admitted to the community their incapability to manage their daily tasks independently. This suggested that the participants felt the need to preserve their dignity by not admitting that they were struggling to remember to carry out their daily tasks so that they would not be seen differently by other residents. The second theme, 'Past the age of learning,' suggested that the participants were unwilling to adopt new ways of coping with memory issues but reported their intentions to continue using their long-established routines. It was interpreted that the participants feared revealing their condition over the concerns that they might be losing their capability to learn new things and be unable to grasp the concepts of using new devices. As a result, older age seemed an acceptable reason that would not invoke more questions about their lack of interest in MAT. The third theme, 'Attitudes towards memory aid technologies,' revealed that the participants viewed MAT less favourably than other technological devices. It suggested that people's attitudes towards MAT were influenced by what the device represented. For instance, eight participants were willing to accept other technologies, such as tablets they already possess. Though some participants, for instance, Doreen, acknowledged the perceived usefulness of MAT, they said they might consider having it later. However, none of them acknowledged needing to use it presently.

These findings suggest that for many participants, memory aid technologies carried a deeper meaning attached to them than just being a device that can be used in memory support. The views found from the participants seemed to have had little to do with the MAT device itself but had everything to do with what it represented, dementia, in the sense that accepting the use of the technology implied that their cognitive difficulties were severe enough to warrant this help. This suggested that their attitudes towards the disease influenced their acceptance of MAT. This study also found that most participants had at least one type of technological device that they might have used for a long time. They had been using the devices for different purposes, which were not about making up for cognitive deficits. For instance, people use phone reminders but not specifically because they have cognitive issues or because this is within the limits they see as socially acceptable. This possession seemed to have contributed to their acceptance to participate in the study, which revealed the impact experience in technology had on participants' openness to technology. It also revealed that technology was being accepted in older populations, as revealed earlier by Schulz et al., (2014). However, acceptance of MAT was based on what it meant to them, what it represented, and what other residents thought about them if they were seen to depend on it.

7.3 Integrating quantitative and qualitative findings

The Technology Acceptance Model provides a framework for understanding technology acceptance behaviours for the intended users, which this study has supported. This means that the model can be used to explain the likeliness of MAT acceptance for targeted users. Perceived Ease of Use and Perceived Usefulness have been found to influence people's attitudes towards MAT acceptance. Other external factors such as education, income, age, experience, sense of competence, and dementia severity could also affect MAT acceptance. While the quantitative findings found that Perceived Ease of Use and Perceived Usefulness was positively associated with MAT acceptance, the qualitative findings revealed that though people might perceive technology as useful and easy to use, they were more factors at play that influenced MAT acceptance. This was demonstrated by participants' willingness to learn other, more complicated tasks such as doing online banking. Also, while some participants, such as Daniel and Doreen, acknowledged the usefulness of MAT, they seemed more concerned about preserving their dignity than accepting MAT at the risk of diminishing their dignity.

7.3.1 Household Income and MAT Access

The hypothesis, which stated that there would be a positive relationship between greater household income levels and MAT access, was not supported. While evidence reveals the benefits of MAT utilisation, income has been reported to determine access to MAT (Thordardottir et al., 2019; World Health Organisation, 2018). However, this study revealed that the participants owned other types of technologies not specifically to help them with a cognitive deficit but used them for activities such as maintaining social connections through communication, gaming, banking, exercising etc. The results also revealed that the caregivers had knowledge of the types of MAT available and where to access and there was no indication of income as a barrier to use. While no income information was collected in the qualitative investigation, it was interesting to note that in the qualitative investigation, only one participant Bob, did not own any technological device such as a smartphone, tablet, laptop, smartwatch or digital calendar. This participant openly expressed his dislike for technology and did not indicate a lack of financial resources as the reason for not having one. As MAT adaption is generally promoted within the UK, the government initiative programs to promote greater access for independence and reduce care costs might contribute to income no longer having a role in access to MAT.

7.3.2 Technology Possession and MAT Acceptance

The hypothesis that there would be a positive relationship between higher technology possession and MAT acceptance was not supported. Technology possession was measured by people's responses to possessing any technology. This revealed that people with other types of technology accepted MAT less than those without any technology. This was possibly due to the need to preserve the dignity of people with dementia using it and not risk exposing themselves to the public when seen with this kind of MAT, as it would impact their social identity. This contradicted the literature suggesting that people with technological devices would accept MAT better than those without ((Thordardottir et al., 2019). These results were also supported by the qualitative findings which showed that most participants possessed technologies for other uses, but they did not accept MAT for support with memory. This also helped shed more light that MAT might be viewed as a constant reminder of their condition, which they might not have come to terms with. As shown earlier, older adults seem warm towards technology (Age UK, 2018; Ofcom, 2020). This revealed a general shift in their attitudes towards technology as more different types of technology are increasingly becoming available. While the literature has revealed a growing interest in technology in older adults, it is interesting that MAT was mostly rejected (Schulz et al., 2014; Age UK, 2018; Ofcom, 2020). The COVID-19 pandemic has made more people realise the important role technology can play in maintaining the quality of life (Pappadà et al., 2021). This arguably increased older adults' attitudes towards technology, but this was not the case with MAT. It would have been assumed that due to the pandemic, which imposed social interaction restrictions, people might have appreciated the relevance of MAT. Therefore, it is crucial to understand the memory aid technological design that is socially acceptable for the targeted population that would not symbolise the dementia condition they had to the public. Knowing this would help future developments of MAT that can be adapted and effectively utilised (Dequanter et al., 2022). This was confirmed in this study that the participants were motivated to use technologies for activities other than memory support. While it is encouraging that technology is being utilised more by older adults than before, rejection of MAT implied that this kind of device conveyed a meaning transcending to more than just another technological device. As Dequanter et al. (2022) highlighted that disease awareness was critical in MAT acceptance, these results suggest an information gap about dementia to members of the public, which led to different issues resulting in people with dementia not wanting to be associated with MAT. Therefore, it is essential to understand the meaning people make of these devices, especially when it is linked to dementia, which can be sensitive to some people.

7.3.3 The relationship between attitudes and MAT acceptance.

The hypothesis that greater attitudes towards MAT would significantly predict MAT acceptance was confirmed, highlighting that attitude had a significant relationship with MAT acceptance. The results were consistent with earlier evidence which showed that people's attitudes towards technology determined its acceptance (Bennett et al.,2017). These results were based on caregivers' views of the people they support and whether they thought they would accept technology. Therefore, if caregivers had negative attitudes towards MAT, this likely determined the attitudes of the people they supported. As literature has shown that caregivers played a significant role in supporting people with dementia in MAT acceptance, they were responsible for introducing and encouraging them to accept MAT (Evans et al., 2015). Also, they were viewed as responsible for providing support for continued use. As TAM proposed, evidence has shown that people's attitudes towards dementia influenced MAT acceptance (König et al., 2021). Earlier studies suggested that dementia was negatively viewed because of symptoms people regarded as socially unacceptable that could be stigmatising, such as disorientation and forgetfulness (Garand et al., 2009). These attitudes likely influenced how MAT was viewed, resulting in people not accepting MAT. Also, the attitudes of people within a community towards dementia and MCI determined people's attitudes towards MAT (Czarnuch et al., 2016). Earlier evidence revealed that dementia was regarded as an undesirable process of ageing, which could result in symptoms that led to stigmatising (Garand et al., 2009). Therefore, people were unwilling to engage in MAT, which made them feel stigmatised as they feared being treated differently by others in their community.

Consequently, this has resulted in dementia being advocated for to be viewed under the social model of disability to protect the rights of people with dementia ((Thomas & Milligan, 2017). This showed that people with dementia were viewed to be disadvantaged within their communities due to barriers they encountered within their communities. Therefore, communities and social settings shaped people's attitudes towards MAT acceptance, which likely played an essential role in MAT acceptance.

7.3.4 Perceived Usefulness (PU) and MAT Acceptance.

The hypothesis that greater levels of PU would significantly predict MAT acceptance was supported. This was in line with the TAM and other literature, which found PU as one of the strong predictors of MAT acceptance (Peek et al., 2014). Though evidence has stated that people's acceptance of the technology was need-based (Dequanter et al., 2022), this seems to be a different case for MAT for people with dementia and cognitive impairments. While people acknowledged the usefulness of MAT and highlighted how it could be effective as a memory aid, they still rejected it. This might be based on the meaning older adults place on these devices. Also, as MAT represented cognitive dysfunction, it could serve them as a constant reminder of their condition that acceptance of MAT would also involve acceptance of an underlying cognitive deficit and the willingness for this to be enacted in public. Therefore, the participants acknowledged the usefulness of MAT, which revealed that people understood the benefits provided by MAT, but they were not willing to accept it for their use.

The qualitative findings also confirmed these results and revealed that technology, in general, was perceived as being useful, even MAT. This was observed through most participants having different types of technologies they used for different activities. For instance, a participant stated that he used his Kindle for reading books and other tasks such as emails (extract C3). Holthe et al., 2018 suggested that technology acceptance varied according to the kind of technologies referred to. For instance, some people perceive other technological devices as useful for different activities. However, MAT was rejected not because it was not perceived as useful but possibly due to what it signalled about users' capabilities (Dequanter et al., 2022). Though people provided different reasons for not accepting MAT, it was interesting how they were willing to learn even more challenging systems that they found appealing.

Moreover, people felt that they were not ready to accept using MAT but mainly reported that it would be helpful for others whom they suspected to have dementia and MCI. This suggested that MAT was generally perceived as useful, but most participants would not accept it for personal use. This presented barriers that led to some people not openly discussing their condition. People indicated that they perceived MAT to be useful. However, there was no indication of intentions to accept MAT use, and the people indicated that they would continue using their diaries to help them remember. Therefore, while this study has revealed a strong relationship between PU and MAT acceptance, it is also essential to understand that it sheds light on other factors contributing to MAT acceptance.

7.3.5 Perceived ease of use (PEOU) and AT acceptance.

PEOU is another factor shown to play a role in technology acceptance. The supported hypothesis stating that greater levels of PEOU would significantly predict MAT acceptance suggested that when people generally perceived certain types of technology to be easy to use, they were likely to accept it. Literature has shown that people were likely to adopt new technology without complications (Davis et al., 1989). This study revealed that most caregivers had experience using other technologies in general; therefore, they were likely to have confidence in supporting people with dementia to use MAT. The qualitative findings revealed that people reported they perceived that MAT would be rugged for them to use. However, it was also found that some participants were willing to learn more challenging programs such as banking (extract C7) on other technological devices they used. This possibly interpreted that the participants implied that they perceived MAT as challenging to use if they did not like it and had no intentions of accepting it. Therefore, people were motivated to engage in technologies that appealed to them regardless of how difficult to use it might be.

7.3.6 Caregiver sense of competence and MAT acceptance.

The supported hypothesis that a lower caregiver sense of competence would be positively associated with MAT acceptance revealed a significant relationship. As shown earlier, caregivers might lack the competence to support their loved ones, primarily as the symptoms increase. Therefore, they were viewed to be motivated to accept MAT, especially in areas they felt inadequate (Sriram et al., 2019). This study revealed that caregivers who cared for people with more severe symptoms accepted MAT more than those with lesser severe symptoms. This implied that when the caregivers felt competent in the way they were providing care, they did not see the need to outsource other ways of providing additional support. However, when they felt less competent in their roles, they could be motivated to accept MAT to compensate for other areas lacking and ease the pressure of caring for their loved ones (Vernooij-Dassen et al., 1999). The qualitative findings revealed that though caregivers supported their loved ones with technology, they did not actively promote using MAT, which could help with memory. This suggested that the caregivers might not need to adopt using MAT as the people they supported had lesser severe symptoms of dementia. This may have been interpreted that they may need more pressure to introduce or encourage the use of MAT. This complemented the quantitative findings, which revealed the caregivers' motivation of people with more severe dementia symptoms, thus supporting the literature. Following these findings, it is worth considering the challenges dementia brings to caregivers and the people affected, particularly as the condition advances. People affected might come to a stage whereby they are no longer capable of making sense of purpose of MAT, which will consequently not serve its intended purpose. Having appropriate technological interventions in place at earlier stages of dementia and MCI might help to introduce MAT. At the same time, they might be capable of making sense of MAT and its relevance.

7.3.7 Age and MAT Acceptance.

Though the hypothesis revealed that the younger caregivers' age group would be positively associated with MAT acceptance was not supported, the findings revealed that older caregivers accepted MAT more than younger caregivers. One possible explanation might be that certain technologies are more acceptable to younger age groups than others. Greater MAT acceptance in caregivers within older age groups suggested that older caregivers felt that MAT would be beneficial to the people they supported. Furthermore, more older caregivers were responsible for providing support, suggesting that caregivers were willing to find additional support as this is also the age group with the highest number of caregivers who provided support to people with dementia than the rest. High acceptance levels in this age group might be arguably driven by the realisation of the need to outsource additional memory aid support to ease their responsibilities based on their experience. However, older age in the qualitative findings was raised as a barrier to accepting MAT as it implied changing their old established routines, which they reported being unwilling to do. Age has been argued to be one influential factor in technology acceptance as younger age groups have been argued to accept technology more than older age groups (Chen & Chan, 2011). While evidence supports this notion, it is imperative to note that it is not just technology in general but the type of technology under consideration. The type of MAT used in this study specifically focused on people with dementia and determined the intended users' attitudes towards it. As found in this study, there were older age groups of caregivers providing support to people with dementia than younger age groups. Having older age groups accept MAT more than younger revealed that they were open-minded when it came to MAT because of the responsibilities of caring they faced. Another possible interpretation is that younger groups rejected MAT more than older groups. It may be due to the generational age gap between the caregivers and those they support. They might be dismissive of the possibility that the people they cared for might consider trying to use MAT. This could be due to stereotypical views based on someone above their generation.

7.3.8 Education and MAT Acceptance

The hypothesis, which stated that higher education levels would be positively associated with MAT acceptance, was not supported, which meant that there was no significant relationship between the education level attained and MAT acceptance. As opposed to literature, education has been said to play a role in technology acceptance, and people with higher levels of education positively viewed technologies more than those with lower levels of education (Berner et al., 2015; König et al., 2018). However, this study revealed no significant difference across the different educational levels. The possible explanation is that as all the caregivers were recruited online, the assumption following these results is that they already had the confidence to deal with technology because of their education which likely played a role in participation. While this study has revealed the non-significance of education in MAT acceptance, other factors need to be explored to understand whether people's attitudes towards technology, in general, are shifting due to its vast availability such that education no longer matters. Literature has shown that people who have spent more time in education mostly accepted technology. This might arguably be the cause for no significant difference as they had some form of education. Alternatively, it may be that education still played a role. However, people's attitudes differed according to the type of technology, what it meant to the user, and what it signalled within different communities.

7.3.9 experience with technology and MAT acceptance

The hypothesis that greater experience with technology would be positively associated with MAT acceptance was also not supported. This revealed no significant relationship between MAT acceptance and experience with technology. Technology experience meant those who had a history of using technologies in the past. This contradicted the literature, which suggested that people's experience with technologies helped them to be more receptive to other types of technologies (Thordardottir et al., 2019). Despite literature showing the significance of experience with technology in MAT acceptance, the findings from this study revealed otherwise. This highlighted that having experience with technology did not warrant that MAT would be accepted. The qualitative findings also supported this, which revealed that people rejected MAT despite having experience using other technological devices. The qualitative findings revealed that people were willing to learn what appealed to them, demonstrated in their effort to learn more advanced technological programs. Some studies pointed out how MAT has been designed specifically for people with dementia, and MCI signified that the user had memory issues which can be viewed as stigmatising (König et al., 2021). While experience with technology might have been a factor in the participants' willingness to participate in this study, it did not influence their acceptance of MAT. This highlighted potential issues in certain types of technologies, particularly MAT, as it represented dementia which seems to be a sensitive subject even to discuss with participants. It is, therefore, essential for due consideration to be taken into account during the development and deployment of these devices.

7.3.10 Dementia Severity and MAT Acceptance

The hypothesis that higher levels of dementia severity would be positively associated with MAT acceptance was supported and revealed a significant relationship. This showed that caregivers of people with greater severe symptoms of dementia accepted MAT more than people with lesser symptoms. This is contrary to what was expected; as dementia is known to be progressive, the individuals affected may lose their capability for new learning, which restricts their technology use (Meiland et al., 2017). Therefore, this study expected the caregivers of people with lesser severe symptoms to accept MAT better as the people they supported might still be capable of comprehending and understanding the significance of MAT (Dequenter et al., 2022). One possible interpretation is that caregivers were motivated to outsource other means of support to relieve themselves of the weight of increasing caring responsibilities. As people with dementia might need greater support as it progresses, caregivers likely experience challenges of exhaustion which could be a source of motivation to find alternative ways of helping their loved ones. Therefore, as the literature suggested, the caregivers were open-minded to MAT to relieve some of the burdens of caring (Kramer, 2013). While this might be arguably ideal and plausible, considering that people with dementia might be capable of understanding MAT, what this study revealed is that caregivers of people with lesser symptoms lacked the motivation to look for additional technological memory aids or were more motivated to maintain an intact social identity - one in which they did not require assistance with their memory. This perspective was also implicated within the qualitative investigation whereby the participants highlighted that people with greater severe cognitive dysfunction would primarily benefit from MAT. This likely meant that people had more severe levels of need; they and their families were more accepting of technology to meet these needs whilst also being less concerned with social appearance.

Additionally, this study has revealed that most caregivers had been providing support full-time. Therefore, most caregivers changed their lifestyle by giving up their jobs to become full-time carers

(Orpwood et al., 2007). With the progressive nature of dementia requiring increased levels of support, this might have been the driving force for higher levels of MAT acceptance.

7.4 Implications of this study and recommendations

The current study sought to understand the attitudes of caregivers of people with dementia on MAT designed for memory support and the attitudes of older adults living with dementia and MCI within the retirement living community. These results shed light on the potential issues surrounding these types of MAT aimed at helping people with memory issues and the importance of utilising psychological models in the design and evaluation of the memory aid devices. Utilising TAM in this study has highlighted importance of understanding psychological processes involved in MAT acceptance. The findings highlighted that people were aware of the memory support devices available, could access them and understood their importance, but these were only sometimes accepted. However, literature has shown the effectiveness of memory aid devices that have been developed, but these need to be utilised. This study also confirmed this, revealing that general technology was widely accepted among older adults living with dementia and MCI. The results suggested that people's attitudes towards MAT were partly influenced by societal attitudes that drove the people affected to conceal their situation from others within their community. Another possibility is that MAT represented a condition, dementia, which people feared particularly in advanced age, and therefore they rejected MAT for reasons of what it represented. For instance, people did not want to identify themselves as someone needing support for their memory due to the stigma associated with dementia (Nguyen & Li, 2020; Herrmann et al., 2018).

For this reason, dementia was not openly discussed within the communities. MAT devices could signal cognitive impairment, which can be stigmatising unless carefully designed and deployed. This consequently would result in people being reluctant to disclose their situation and accept MAT because of the need to maintain the appearance of competence (Charness et al., 2012). This suggested that people did not want to be seen using MAT because people within their community might talk about them based on what it represented; old age, dementia, behaviours viewed as unsociable, and losing their capability to live independently. This is due to the stigma associated with dementia which past research has pointed out that people did not wish to position themselves as needing help (Sabat et al., 2004; König et al., 2021; Garand et al., 2009). The participants' other technological devices had memory support features they could use without raising suspicions, but these were not utilised. It might be that their rejection of technology was based by their perceptions of dementia and how utilising the memory aid features could be a constant reminder of their condition. They might also be 'pushing away an acknowledgement' of their dementia (Cheston, 2013), and devices such as MAT might not improve the situation. While technology was generally perceived as difficult to use, people showed motivation for technological devices that appealed to them and did not signal dementia, as this study revealed. However, with MAT, though people echoed their views that MAT was useful, they did not accept it for their personal use but stated that it would be ideal for other people with severe memory problems. This was also supported by the quantitative investigation whereby a higher proportion of people owned other types of technology, and a higher proportion rejected MAT.

While some available studies have highlighted the effectiveness of MAT in achieving its intended purpose (Lancioni et al., 2014; Lancioni et al., 2009), these studies were mainly conducted to test the devices to establish whether they work effectively. It is justified to assume that a sizeable body of evidence available around these MAT was conducted by the people responsible for designing and implementing these devices. This implied that the people involved might be engineers who need more expertise to apply a theoretical framework to understand people's perceptions and attitudes towards MAT. The issue likely to be encountered with this is that these kinds of MAT were designed not fully understanding the needs of the targeted population. This consequently presents the challenges of having numerous MAT devices that still need to be fully utilised on the market.

The results from this study have highlighted the issues around people's attitudes towards dementia. As these MATs are specifically designed for people with dementia and MCI, they represent a dreadful disease of dementia, which is feared, hence the reasons for MAT rejection. Understanding people's cognitive processes surrounding dementia might help to answer some questions about the utilisation of MAT, which can also help to design MAT devices that can be appealing. For instance, experts within the field of health psychology can help identify the underlying factors that drive MAT acceptance behaviours, thereby designing effective technological interventions. They work to understand the mechanisms of actions, identify targeted behaviour change techniques, and ensure they are delivered and engaged as planned. Health psychologists could be involved during the development stages of these MAT to investigate illness perceptions likely influencing people's acceptance of MAT. They could utilise psychological models such as the COM-B model alongside TAM to understand user behaviour and people's perceptions by evaluating the theoretical constructs that have been found to determine behavioural change. Determining this would help develop and implement effective technological interventions that consider important sensitive issues for intended users and find ways to overcome them.

A greater proportion of caregivers caring for people with questionable cognitive impairment did not accept MAT. However, one might have assumed that the best time to introduce technology was during the early stages of dementia. At the same time, the individual might still be capable of learning and understanding the significance of MAT. Surprisingly this was not so in this study, as caregivers of people with mild to questionable dementia rejected MAT. This suggested several potential issues; firstly, the caregivers might not have come to terms with the reality of the condition of their loved ones. Secondly, it might imply that the caregiver might not want to impose the idea of the likeliness of dementia on those with no formal diagnosis. Thirdly, people with dementia might be reluctant to acknowledge their need for additional support, fearing it would take away their independence. This could be another area of potential issues around MAT acceptance. As highlighted in other studies, caregivers play an equally important role in the acceptance of MAT; having them involved in the design of MAT and providing their contribution also makes a difference in how it is presented and viewed among people with dementia and MCI.

As earlier evidence has shown, older people increasingly embrace technology, as revealed in this study. While this may be so, it was interesting to note that MAT could have been more effectively utilised. Instead, the qualitative findings revealed that age was being implicated as a barrier to accepting MAT because of reluctance to change their long-held habits. Perhaps the main reason is that its presence would constantly remind them of their condition. If people find it challenging to come to terms with a dementia diagnosis, constantly reminding them of their condition might be detrimental to their overall well-being. This is because it might be a source of anxiety whenever they view the device. As evidence has shown that dementia carries some stigma, people might think they would be viewed differently when people around them know of their diagnosis (Sabat et al., 2004). While technology is becoming more acceptable within the older adult age groups, the issue of MAT being underutilised is an area that now requires greater focus. Developing technological interventions would need to take into consideration the best devices to use that do not only represent such conditions but provide interventions to provide devices that are empowering to the targeted users.

This study also revealed that dementia was not openly discussed among older adults, which could be sensitive. This reveals potential challenges faced within communities, such as retirement living developments and wanting to be socially acceptable to the point of declining MAT that can help them maintain their independence for longer. For instance, Betty expressed concerns about MAT taking over her independence. This suggested that people were unwilling to engage with MAT, potentially labelling them as incompetent, which was viewed as diminishing. Though other participants reported knowing that some people within the community had dementia, no one came into the open to talk about it. It may well be essential to consider that people might be at different stages of accepting their diagnosis;

therefore, having dementia might result in some people becoming anxious and socially withdrawn. Also, the caregivers might try to avoid implicating the idea to the people they support that they are becoming a burden, hence their reason to provide MAT to substitute their commitments. Due to this, caregivers might not want their loved ones to feel unwanted or neglected. Therefore, some might continue to care for them without additional support, such as MAT. As revealed in the literature and this study, caregivers commit much time to provide their loved ones as much support as possible. This study also revealed that caregivers played an essential role in dementia care. If caregivers had confidence in MAT, they were likelier to instil that confidence in the person they support. However, if they perceived MAT negatively, they might not encourage the people they support to embrace it.

Another implication is that stigma can occur due to a lack of understanding about dementia and its effects (Garand et al., 2009). This lack of understanding might cause people to become fearful of the dementia diagnosis and feelings of worry that they might be treated differently if people find out about their diagnosis (Meiland et al., 2017). This possibly explained why people did not disclose their condition to community members. When people develop dementia and MCI, they would not want to be viewed or treated differently. Therefore, to preserve their self-identity, they may find the need to keep their condition a secret until people within the community start noticing some problems associated with dementia.

7.5 Recommendations for future research

The findings from this study have shown that MAT can be easily accessed by those who need it. It contributes to the limited evidence regarding technology acceptance among older adults with dementia and MCI. They underline that the successful adoption of MAT needs to appeal to the individuals it targets. However, this study has revealed that targeted users do not widely accept MAT. This is because MAT is specifically developed for people with dementia or MCI to help them remember some of their daily tasks.

People did not want to be seen as incapable, and using this type of MAT would imply that to other people in the community. Therefore, it is essential to understand the targeted audience's views on technologies being developed to understand what would make them accept technologies and identify barriers to establish ways to address these.

The quantitative investigation revealed that a greater proportion of the black ethnic group (83.3%, table 1.11) did not accept MAT. This requires further exploration to understand how people make meaning of technology in black ethnic groups. Future studies might want to focus on understanding technology acceptance in ethnic minority groups, seeking to understand what technology might mean to them. The results showed that most people from black ethnic backgrounds rejected MAT more than they accepted it. Nevertheless, most participants from white ethnic backgrounds accepted MAT more than they rejected it.

Providing psychoeducation to communities might help to alter people's views on dementia and cognitive impairments. The rise in the prevalence of dementia cases, mainly due to the ageing population, might cause some older adults to live in fear of dementia, unwilling to talk about dementia and not opening to information that would help. It might help to ensure that people do not feel stigmatised and would learn that it is possible to have a quality of life while living with dementia and utilising the available resources to maintain their independence. Though existing attempts have been made, such as the dementia friends initiative, however, this needs to be carefully structured for people in communities to accept. It is important for people within different community settings to be educated on dementia and MCI to gain understanding. Perhaps using the COM-B model of behaviour change to evaluate people's position while understanding the meaning they make of technology might provide future direction in its development and adoption.

While the UK government is making efforts to ensure that people living with dementia live more independently with fewer social barriers, psychoeducational interventions must be implemented to educate the public on dementia awareness, its effects, the symptoms, and the rights of people with dementia. Literature has also revealed the lack of dementia awareness and that dementia has been advocated to be viewed as a disability. This was implemented so that people with dementia should not be treated any differently from the rest of the population and social barriers have been implicated. These barriers make people ashamed of their condition, therefore, unwilling to disclose it. This suggests that many people delay seeking support that could help maintain their independence for longer and other interventions that could reduce stress and anxiety. It is essential for people to know what it means to live with dementia from the perspective of people living with this condition. These should be aimed at everyone as no one will know when they might be in a situation requiring engaging in this knowledge. Having people in different communities understand facts about dementia would reduce the issues of stigmatisation and anxiety, which could result in more people coming into the open and actively seeking help. This will also encourage people to use technological devices that suit their needs without worrying about what others might think. Knowledge of disease in people with dementia and older adults should be made a priority for people to be aware as the disease and ways to support it. This would reduce stigmatisation and break barriers that will allow people to discuss it openly. This would also reduce the amount of stress and anxiety and encourage people to seek help should they notice signs of cognitive changes and live at ease without having pressures to keep their condition a secret.

As symptoms of dementia differ with each individual, one-to-one technological interventions are recommended, and not one size fits all approach. People's views must be understood to develop awareness programs to change people's attitudes towards dementia. However, understanding this condition and how it affects people differently might result in people accepting MAT. Varying support needs are needed for caregivers and people with dementia. Therefore, future research may consider finding different support needs of caregivers and people with dementia at different stages.

People's attitudes toward MAT in retirement settings differ from those living in their homes, where they only have close social connections. Therefore, future studies may want to explore how MAT acceptance vary in different residential settings. Also, MAT acceptance might be influenced by the social settings where the intended users are based. Future technology development should be done in consideration of different social contexts and environmental appropriateness. This would remove the barriers to technology acceptance and help people maintain their sense of dignity within their social setting.

Furthermore, during the designing and deploying these MAT, it is essential to consider designing for different types of settings as it would make a difference in how it is viewed and accepted. This study has shown that older adults are willing to engage in technology that appeals to them regarding its usefulness and maintains their sense of dignity. This represents progress and reveals a shift in how technology is viewed and adopted among the older adult population. However, what now needs more focus is establishing ways to utilise the much-needed technologies. It is considered essential for healthcare professionals to be trained on how to effectively communicate with people affected so that people will not feel anxious and afraid of dementia. Professionals such as service managers within retirement living settings are able to dictate these signs early. Having them trained would enable them to communicate confidently with families as individuals, encouraging them to have technologies in place to help them live more efficiently.

This leaves behind the need to seek the contributions of the intended users in the design and development of these MAT, thereby missing more critical areas to focus on, as this study has uncovered. Furthermore, most studies that are carried out on MAT are to ensure that the technologies are working in ways they are intended to. While these efforts are commendable, a gap exists in understanding the intended users' needs, resulting in their non-acceptance. Therefore, to overcome this issue, it is recommended to figure out ways to design MAT that are acceptable to intended users without having people feel diminished. This would require engaging the intended users, clinicians, and academic professionals (such as health psychologists equipped with knowledge and expertise in utilising theoretical models) during the design stages of the MAT development to collaboratively work to ensure that the presentations of MAT do not threaten users' sense of dignity. The best approach would be to ensure that the intended people's views are understood, to ensure these technologies would maintain people's dignity and not expose their condition to general members of the public.

7.6 Strengths and limitations of the current study

Firstly, using the mixed research method, which collected quantitative data from caregivers and qualitative data from people with dementia, helped to gather more detailed data for credible findings. This is considered a strength because the opinions of the people with dementia and their caregivers count when making decisions about MAT acceptance. Therefore, this study used appropriate methods to collect data which provided balanced opinions on MAT. This revealed a balance in the data collected as decisions on MAT use are mostly jointly made. Utilising the mixed research method benefited from using different data collection methods on the same subject, facilitating a good sample size. Having a good sample size allows for more generalisability of the results. Integrating the two types of data benefited from the detailed, contextualised insights derived from qualitative data and the generalisable, externally valid insights of quantitative data. This meant that the strength of one type of data mitigated the weaknesses of the other. This facilitated the findings to be put in context, which added richer detail to the conclusions as one method was used to explain the other. The triangulation process of integrating the findings from both approaches strengthened the validity of the conclusions for this study. Furthermore, utilising theoretical models to guide this study helped to disentangle the essential factors involved in MAT acceptance which can enhance future studies.

Though the surveys were also made available offline to make available for those with no technology access and early adopters, all the participants who took part were recruited online. This presented some limitations in that only people who already had exposure to technology participated, which might influence how these results could be viewed. Having early adopters take part might have revealed different findings. It would have been interesting to have obtained the views of non-users of technology or early adopters to understand their views. The recruitment of participants in retirement living residential settings might not represent a broader cross-section of people with dementia. However, this approach gave a different perspective on the role played within these retirement villages, as these types of residential settings are rising within the UK. It shows areas that can be targeted as these settings will comprise a community of older adults. Therefore, finding ways to address these barriers would motivate more people to use MAT and facilitate higher acceptance of MAT, increasing user behaviour.

7.7 Original Contribution of this Study

This study utilised the mixed research method, which collected views from caregivers using a quantitative approach and people with dementia views using a qualitative approach. Furthermore, the qualitative approach used the MemRabel digital calendar to demonstrate how memory aid devices can be used. The researcher had no direct link with the developers of this device used, which provided an independent perspective from the researcher and facilitated neutral views on the device. To the best of our knowledge, no other research has been carried out using this approach whereby; caregivers responded to a survey while people with dementia took part in interviews following a demonstration of a memory aid device.

While it is encouraging that technology is now being embraced more by older adults, it is equally important to understand why some types of technologies are more acceptable than others. This study, guided by the technology acceptance model, has unveiled that people's broader views of their identity by preserving dignity are much more important than the benefits of using MAT. This shows the importance of using theoretical models in research as it uncovers underlying psychological factors influencing technology acceptance. This study has revealed that certain kinds of technologies are accepted more by people with dementia than others. People are willing to learn to use even more complicated systems they feel would add value to them. Some MAT designed to focus on memory support for people with dementia has mainly been found to be stigmatising as it signified that the person using it has dementia. This exposes their condition to members of the public, which can be a sensitive issue for people with dementia as they risk losing their sense of dignity and identity, which influences their attitudes towards MAT.

This study has shown that people are unwilling to accept help at the cost of their dignity, no matter how good MAT might be. They place great value on their dignity and are reluctant to engage with MAT, which will make them feel diminished. The issue is that people responsible for designing these technologies likely make assumptions about what they think is needed by intended users based on their knowledge of the typical challenges of cognitive deficits.

7.8 Conclusion

Where does TAM sit with your research?

The technology acceptance model helps us to understand technology acceptance and usage behaviour for intended users. This study has revealed that though people might perceive technology as useful and easy to use, they might not intend to use it if they feel it might diminish their reputation. It reflects people's positions about their thoughts on MAT, which could be an explanation for why it is not widely accepted. This reveals the importance of being guided by theory when conducting research. It guides researchers to understand why it is not accepted if people think it is useful and easy to use. For instance, the theme of self-preservation of dignity could explain why MAT is not widely accepted. The other theme might reveal that people were concerned that they might not be capable of learning to use new technology due to their condition. This meant that while they found MAT useful and easy to use, there were other concerns about their learning capability. The third theme revealed that acceptance was based on people's attitudes towards MAT which were driven by their views of dementia.

Other psychological models, such as the COM-B model, can be used in support of the TAM. This model considers Capability, Opportunity and Motivation for any behaviour to change (Michie et al.,2014). If people felt capable and had the resources, intrinsic motivation, which may have to do with outlook and opportunity, might reveal their willingness to engage in technology usage behaviour.

Dementia is one of the biggest challenges that our society faces today. With an ageing population, the number of cases is predicted to continue to rise by over 2 million by 2051 ("Statistics about dementia and MCI | Dementia and MCI Statistics Hub", 2020). The future of technology in dementia care is providing promising solutions that can make a difference if utilised by intended users. This study has shown that the type of technology and its contextual characteristic that is specific to this population is essential to ensure its acceptance. While social settings play a massive role in older adults' mental wellness by facilitating social support and reducing risks of social isolation, it also challenges people to want to live up to other people's acceptable behaviours. It is essential to be mindful that people need the confidence to maintain their dignity and sense of self-worth, value their independence, and want to maintain quality of life. Anything that seems diminishing would put them off as they want to continue being fitting members of their communities. This study revealed that old age and incompetence were irrelevant if they were motivated to use technology. Therefore, the mandate is to help people get the motivation to use MAT, as it will make a difference in dementia care.

The future seems bright with technology once successfully deployed, implemented, and accepted by its target users. MAT has the potential to make an impact on dementia care. While it is encouraging that more devices are available on the market, ensuring that they represent the needs of the intended users is of greater importance. As researchers and designers have made a great effort in working to provide technological solutions in dementia care, all these efforts will be in vain if the MAT produced fail to support people's fundamental values.

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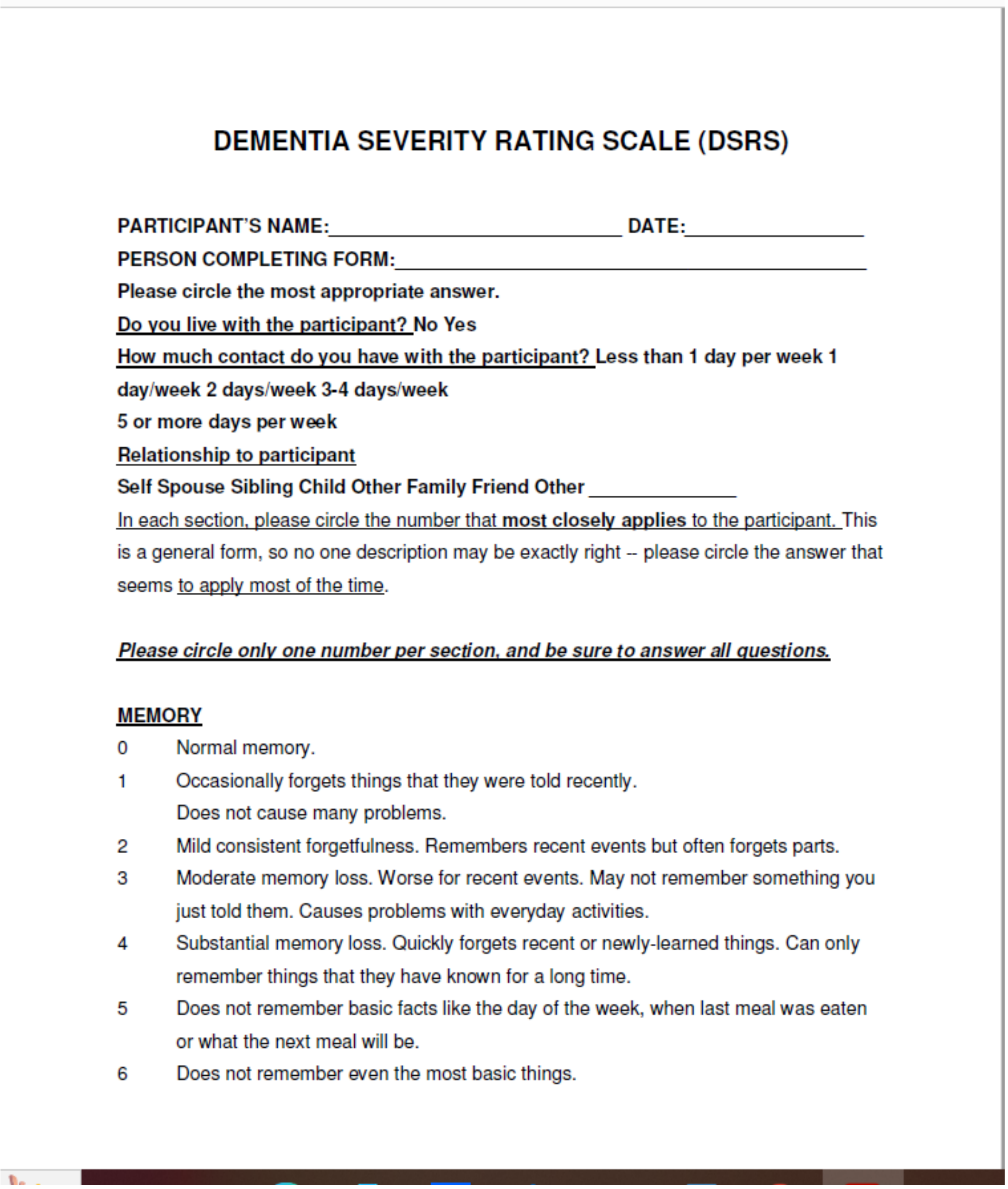
Appendices

Appendix 1: DSRS scale page 1



DEMENTIA SEVERITY RATING SCALE (DSRS)

PARTICIPANT'S NAME:__________________________ DATE:________________
PERSON COMPLETING FORM:____
Please circle the most appropriate answer.
Do you live with the participant? No Yes
How much contact do you have with the participant? Less than 1 day per week 1 day/week 2 days/week 3-4 days/week
5 or more days per week
Relationship to participant
Self Spouse Sibling Child Other Family Friend Other ______________

In each section, please circle the number that **most closely applies** to the participant. This is a general form, so no one description may be exactly right -- please circle the answer that seems to apply most of the time.

Please circle only one number per section, and be sure to answer all questions.

MEMORY

0 Normal memory.
1 Occasionally forgets things that they were told recently. Does not cause many problems.
2 Mild consistent forgetfulness. Remembers recent events but often forgets parts.
3 Moderate memory loss. Worse for recent events. May not remember something you just told them. Causes problems with everyday activities.
4 Substantial memory loss. Quickly forgets recent or newly-learned things. Can only remember things that they have known for a long time.
5 Does not remember basic facts like the day of the week, when last meal was eaten or what the next meal will be.
6 Does not remember even the most basic things.

DEMENTIA SEVERITY RATING SCALE (DSRS)

SPEECH AND LANGUAGE

0 Normal ability to talk and to understand others.
1 Sometimes cannot find a word, but able to carry on conversations.
2 Often forgets words. May use the wrong word in its place. Some trouble expressing thoughts and giving answers.
3 Usually answers questions using sentences but rarely starts a conversation.
4 Answers questions, but responses are often hard to understand or don't make sense. Usually able to follow simple instructions.
5 Speech often does not make sense. Can not answer questions or follow instructions.
6 Does not respond most of the time.

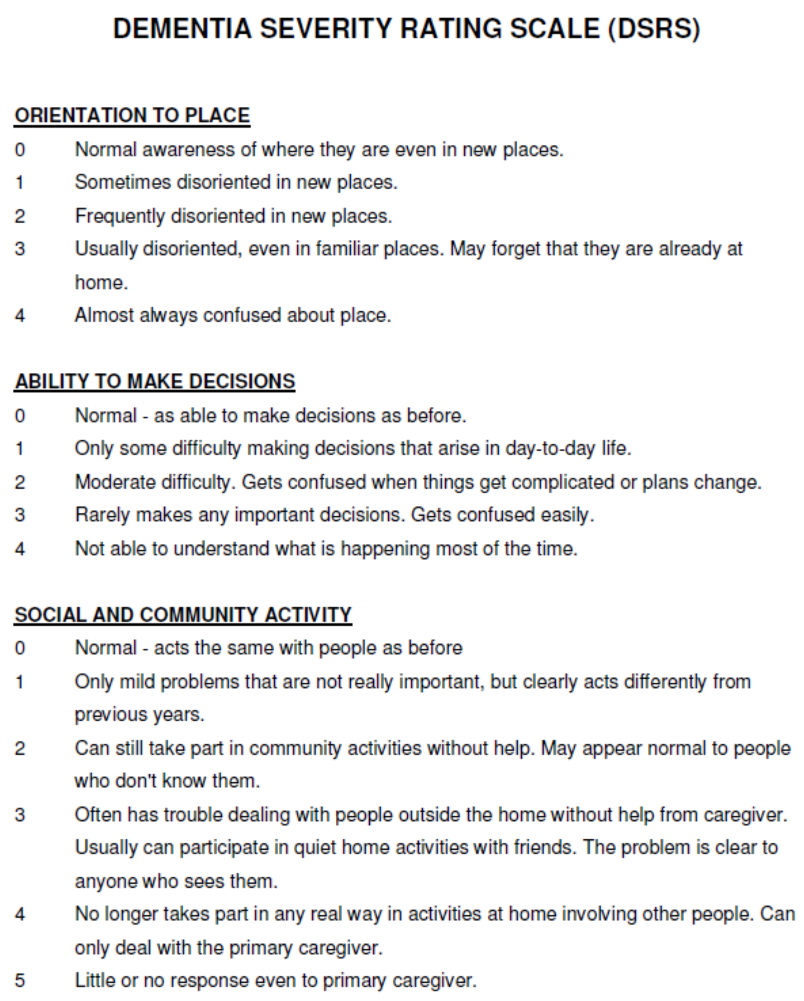
RECOGNITION OF FAMILY MEMBERS

0 Normal - recognizes people and generally knows who they are.
1 Usually recognizes grandchildren, cousins or relatives who are **not** seen frequently but may not recall how they are related.
2 Usually does not recognize family members who are not seen frequently. Is often confused about how family members such as grandchildren, nieces, or nephews are related to them.
3 Sometimes does not recognize close family members or others who they see frequently. May not recognize their children, brothers, or sisters who are not seen on a regular basis.
4 Frequently does not recognize spouse or caregiver.
5 No recognition or awareness of the presence of others.

ORIENTATION TO TIME

0 Normal awareness of time of day and day of week.
1 Some confusion about what time it is or what day of the week, but not severe enough to interfere with everyday activities.
2 Frequently confused about time of day.
3 Almost always confused about the time of day.
4 Seems completely unaware of time.

DSRS page 3



DEMENTIA SEVERITY RATING SCALE (DSRS)

ORIENTATION TO PLACE

0 Normal awareness of where they are even in new places.
1 Sometimes disoriented in new places.
2 Frequently disoriented in new places.
3 Usually disoriented, even in familiar places. May forget that they are already at home.
4 Almost always confused about place.

ABILITY TO MAKE DECISIONS

0 Normal - as able to make decisions as before.
1 Only some difficulty making decisions that arise in day-to-day life.
2 Moderate difficulty. Gets confused when things get complicated or plans change.
3 Rarely makes any important decisions. Gets confused easily.
4 Not able to understand what is happening most of the time.

SOCIAL AND COMMUNITY ACTIVITY

0 Normal - acts the same with people as before
1 Only mild problems that are not really important, but clearly acts differently from previous years.
2 Can still take part in community activities without help. May appear normal to people who don't know them.
3 Often has trouble dealing with people outside the home without help from caregiver. Usually can participate in quiet home activities with friends. The problem is clear to anyone who sees them.
4 No longer takes part in any real way in activities at home involving other people. Can only deal with the primary caregiver.
5 Little or no response even to primary caregiver.

DEMENTIA SEVERITY RATING SCALE (DSRS)

HOME ACTIVITIES AND RESPONSIBILITIES

0 Normal. No decline in ability to do things around the house.

1 Some problems with home activities. May have more trouble with money management (paying bills) and fixing things. Can still go to a store, cook or clean. Still watches TV or reads a newspaper with interest and understanding.

2 Makes mistakes with easy tasks like going to a store, cooking or cleaning. Losing interest in the newspaper, TV or radio. Often can't follow a long conversation on a single topic.

3 Not able to shop, cook or clean without a lot of help. Does not understand the newspaper or the TV. Cannot follow a conversation.

4 No longer does any home-based activities.

PERSONAL CARE - CLEANLINESS

0 Normal. Takes care of self as well as they used to.

1 Sometimes forgets to wash, shave, comb hair, or may dress in wrong type of clothes. Not as neat as they used to be.

2 Requires help with dressing, washing and personal grooming.

3 Totally dependent on help for personal care.

EATING

0 Normal, does not need help in eating food that is served to them.

1 May need help cutting food or have trouble with some foods, but basically able to eat by themselves.

2 Generally able to feed themselves but may require some help. May lose interest during the meal.

3 Needs to be fed. May have trouble swallowing.

DEMENTIA SEVERITY RATING SCALE (DSRS)

CONTROL OF URINATION AND BOWELS

0 Normal - does not have problems controlling urination or bowels except for physical problems.
1 Rarely fails to control urination (generally less than one accident per month).
2 Occasional failure to control urination (about once a week or less).
3 Frequently fails to control urination (more than once a week).
4 Generally fails to control urination and frequently can not control bowels.

ABILITY TO GET FROM PLACE TO PLACE

0 Normal, able to get around on their own. (May have physical problems that require a cane or walker).
1 Sometimes gets confused when driving or taking public transportation, especially in new places. Able to walk places alone.
2 Cannot drive or take public transportation alone, even in familiar places. Can walk alone outside for short distances. Might get lost if walking too far from home.
3 Cannot be left outside alone. Can get around the house without getting lost or confused.
4 Gets confused and needs help finding their way around the house.
5 Almost always in a bed or chair. May be able to walk a few steps with help, but lacks sense of direction.
6 Always in bed. Unable to sit or stand.

INTERPRETATION
Add up the points for all sections.

Score
0-18 --- Mild
19-36 -- Moderate
37-54 -- Severe

Author:

Dr. Christopher M Clark, Alzheimer's Disease Core Center
Department of Neurology, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Appendix 2: Privacy policy notice

Bristol of the West of England

Research Privacy Notice for Research Participants

Purpose of the Privacy Notice

This privacy notice explains how the University of the West of England, Bristol (UWE) collects, manages and uses your personal data before, during and after you participate in the research study titled: "Accessibility and acceptability of memory aid technologies for independently living seniors with cognitive impairment or mild dementia and caregivers for quality of life enhancement." Personal data' means any information relating to an identified or identifiable natural person (the data subject). An 'identifiable natural person' is one who can be identified, directly or indirectly, including by reference to an identifier such as a name, an identification number, location data, an online identifier, or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

This privacy notice adheres to the General Data Protection Regulation (GDPR) principle of transparency. This means it gives information about:

- How and why your data will be used for the research;
- What your rights are under GDPR; and
- How to contact UWE Bristol and the project lead in relation to questions, concerns or exercising your rights regarding the use of your personal data.

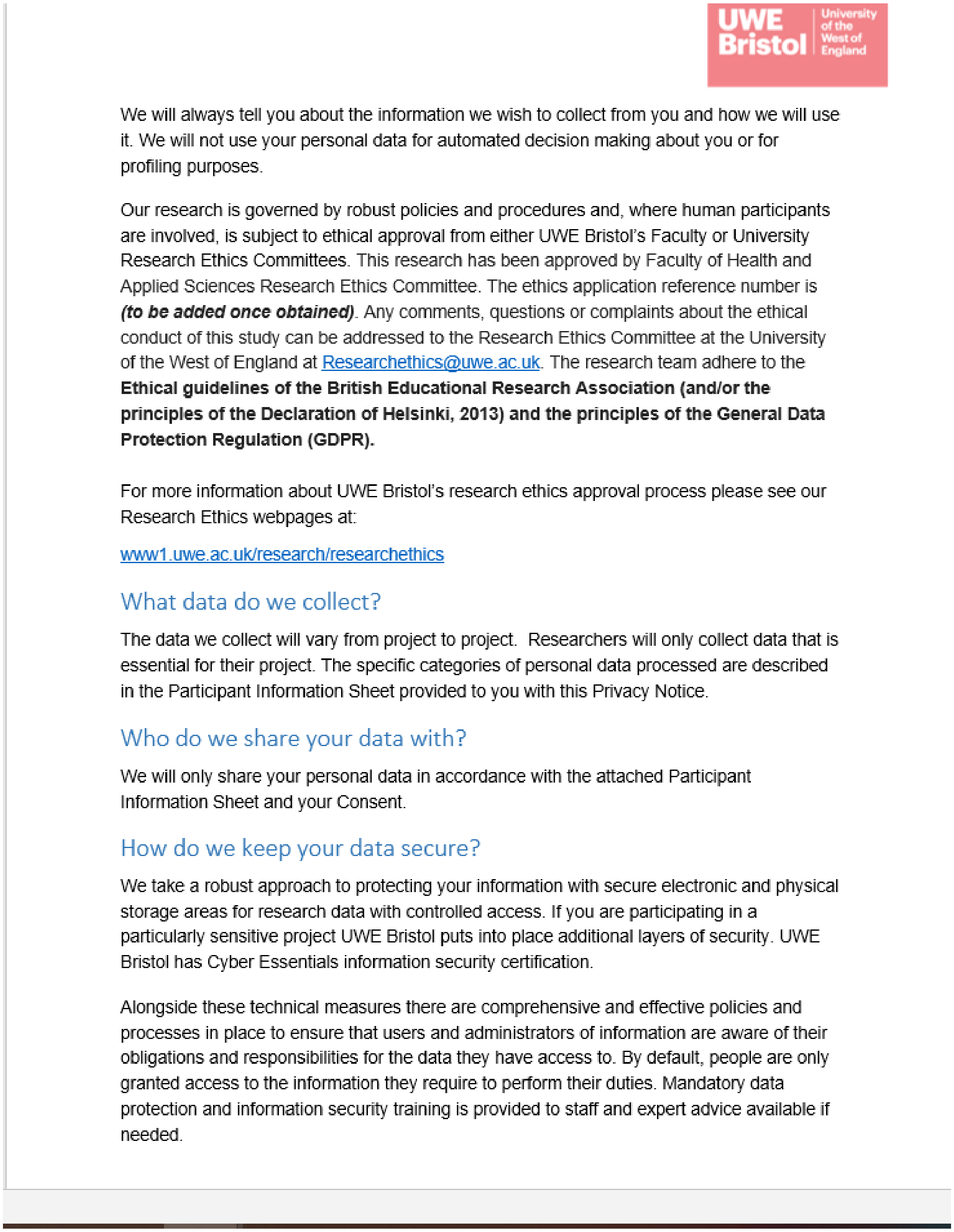
This Privacy Notice should be read in conjunction with the Participant Information Sheet and Consent Form provided to you before you agree to take part in the research.

Why are we processing your personal data?

UWE Bristol undertakes research under its public function to provide research for the benefit of society. As a data controller we are committed to protecting the privacy and security of your personal data in accordance with the (EU) 2016/679 the General Data Protection Regulation (GDPR), the Data Protection Act 2018 (or any successor legislation) and any other legislation directly relating to privacy laws that apply (together "the Data Protection Legislation"). General information on Data Protection law is available from the Information Commissioner's Office (https://ico.org.uk/).

How do we use your personal data?

We use your personal data for research with appropriate safeguards in place on the lawful bases of fulfilling tasks in the public interest, and for archiving purposes in the public interest, for scientific or historical research purposes.



UWE Bristol University of the West of England

We will always tell you about the information we wish to collect from you and how we will use it. We will not use your personal data for automated decision making about you or for profiling purposes.

Our research is governed by robust policies and procedures and, where human participants are involved, is subject to ethical approval from either UWE Bristol's Faculty or University Research Ethics Committees. This research has been approved by Faculty of Health and Applied Sciences Research Ethics Committee. The ethics application reference number is ***(to be added once obtained)***. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England at Researchethics@uwe.ac.uk. The research team adhere to the **Ethical guidelines of the British Educational Research Association (and/or the principles of the Declaration of Helsinki, 2013) and the principles of the General Data Protection Regulation (GDPR).**

For more information about UWE Bristol's research ethics approval process please see our Research Ethics webpages at:

www1.uwe.ac.uk/research/researchethics

What data do we collect?

The data we collect will vary from project to project. Researchers will only collect data that is essential for their project. The specific categories of personal data processed are described in the Participant Information Sheet provided to you with this Privacy Notice.

Who do we share your data with?

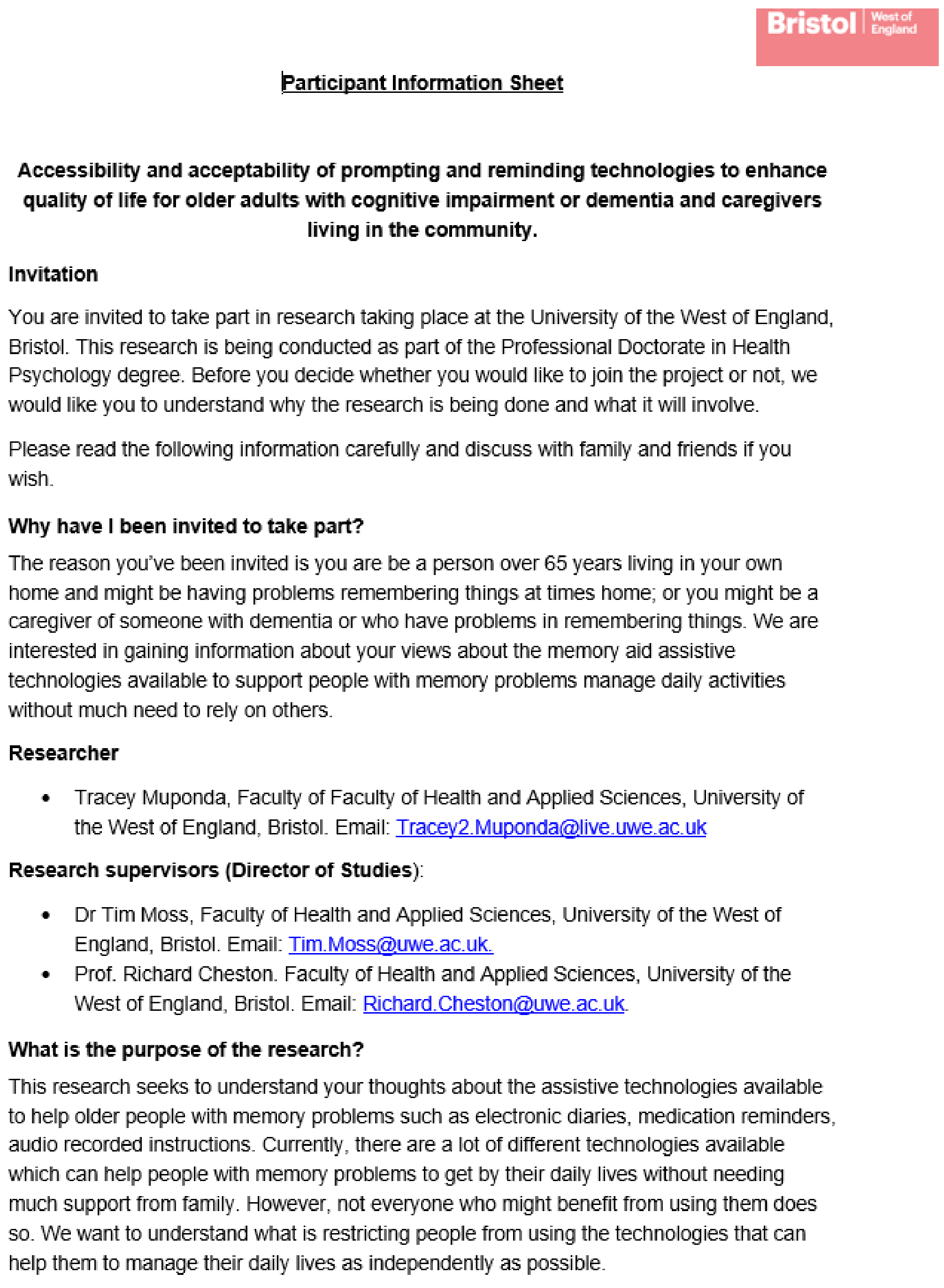
We will only share your personal data in accordance with the attached Participant Information Sheet and your Consent.

How do we keep your data secure?

We take a robust approach to protecting your information with secure electronic and physical storage areas for research data with controlled access. If you are participating in a particularly sensitive project UWE Bristol puts into place additional layers of security. UWE Bristol has Cyber Essentials information security certification.

Alongside these technical measures there are comprehensive and effective policies and processes in place to ensure that users and administrators of information are aware of their obligations and responsibilities for the data they have access to. By default, people are only granted access to the information they require to perform their duties. Mandatory data protection and information security training is provided to staff and expert advice available if needed.

Appendix 3: PIS qualitative



Participant Information Sheet

Accessibility and acceptability of prompting and reminding technologies to enhance quality of life for older adults with cognitive impairment or dementia and caregivers living in the community.

Invitation

You are invited to take part in research taking place at the University of the West of England, Bristol. This research is being conducted as part of the Professional Doctorate in Health Psychology degree. Before you decide whether you would like to join the project or not, we would like you to understand why the research is being done and what it will involve.

Please read the following information carefully and discuss with family and friends if you wish.

Why have I been invited to take part?

The reason you've been invited is you are be a person over 65 years living in your own home and might be having problems remembering things at times home; or you might be a caregiver of someone with dementia or who have problems in remembering things. We are interested in gaining information about your views about the memory aid assistive technologies available to support people with memory problems manage daily activities without much need to rely on others.

Researcher

- Tracey Muponda, Faculty of Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Tracey2.Muponda@live.uwe.ac.uk

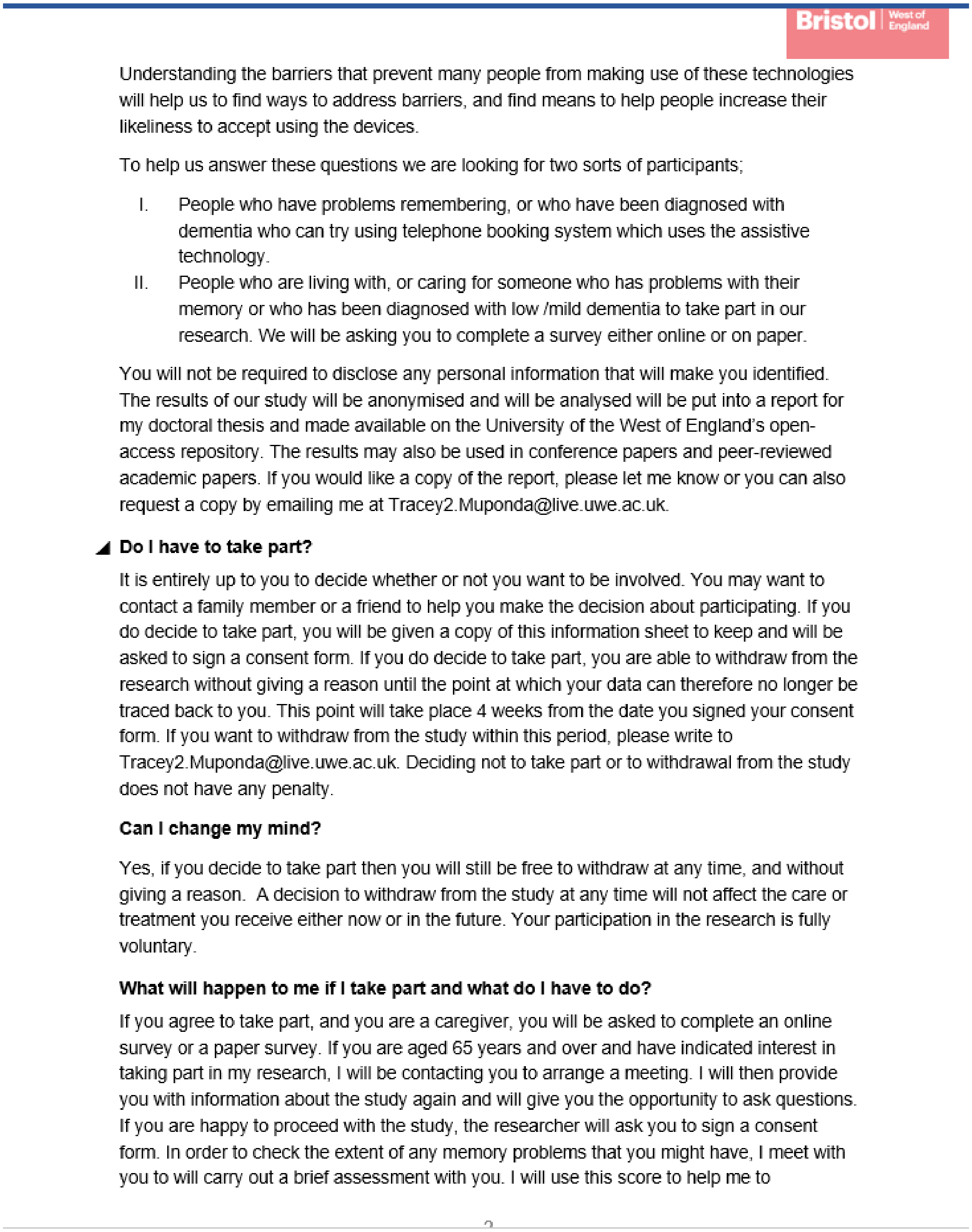
Research supervisors (Director of Studies):

- Dr Tim Moss, Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Tim.Moss@uwe.ac.uk.
- Prof. Richard Cheston. Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Richard.Cheston@uwe.ac.uk.

What is the purpose of the research?

This research seeks to understand your thoughts about the assistive technologies available to help older people with memory problems such as electronic diaries, medication reminders, audio recorded instructions. Currently, there are a lot of different technologies available which can help people with memory problems to get by their daily lives without needing much support from family. However, not everyone who might benefit from using them does so. We want to understand what is restricting people from using the technologies that can help them to manage their daily lives as independently as possible.

PIS page 2



Understanding the barriers that prevent many people from making use of these technologies will help us to find ways to address barriers, and find means to help people increase their likeliness to accept using the devices.

To help us answer these questions we are looking for two sorts of participants;

I. People who have problems remembering, or who have been diagnosed with dementia who can try using telephone booking system which uses the assistive technology.
II. People who are living with, or caring for someone who has problems with their memory or who has been diagnosed with low /mild dementia to take part in our research. We will be asking you to complete a survey either online or on paper.

You will not be required to disclose any personal information that will make you identified. The results of our study will be anonymised and will be analysed will be put into a report for my doctoral thesis and made available on the University of the West of England's open-access repository. The results may also be used in conference papers and peer-reviewed academic papers. If you would like a copy of the report, please let me know or you can also request a copy by emailing me at Tracey2.Muponda@live.uwe.ac.uk.

Do I have to take part?

It is entirely up to you to decide whether or not you want to be involved. You may want to contact a family member or a friend to help you make the decision about participating. If you do decide to take part, you will be given a copy of this information sheet to keep and will be asked to sign a consent form. If you do decide to take part, you are able to withdraw from the research without giving a reason until the point at which your data can therefore no longer be traced back to you. This point will take place 4 weeks from the date you signed your consent form. If you want to withdraw from the study within this period, please write to Tracey2.Muponda@live.uwe.ac.uk. Deciding not to take part or to withdrawal from the study does not have any penalty.

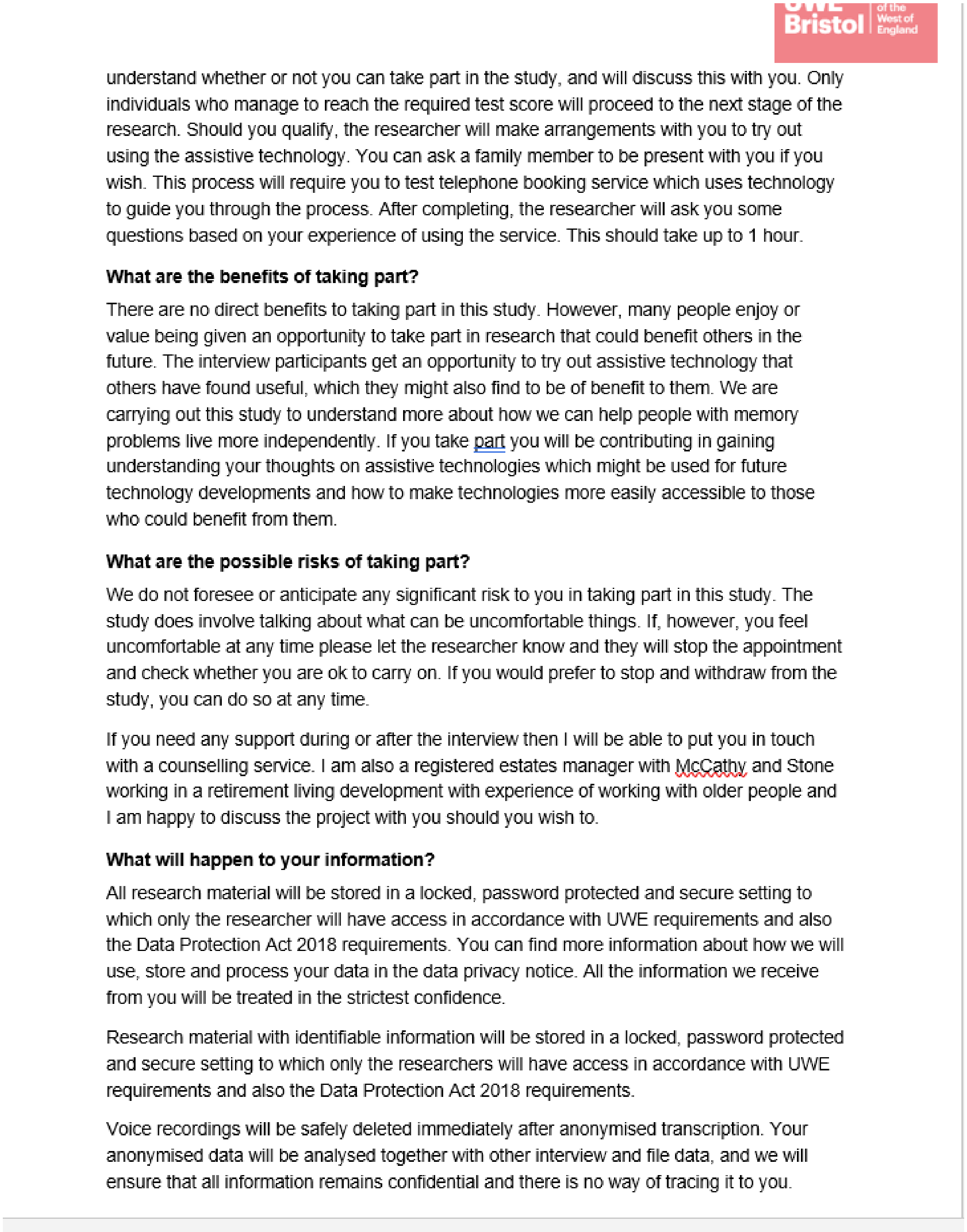
Can I change my mind?

Yes, if you decide to take part then you will still be free to withdraw at any time, and without giving a reason. A decision to withdraw from the study at any time will not affect the care or treatment you receive either now or in the future. Your participation in the research is fully voluntary.

What will happen to me if I take part and what do I have to do?

If you agree to take part, and you are a caregiver, you will be asked to complete an online survey or a paper survey. If you are aged 65 years and over and have indicated interest in taking part in my research, I will be contacting you to arrange a meeting. I will then provide you with information about the study again and will give you the opportunity to ask questions. If you are happy to proceed with the study, the researcher will ask you to sign a consent form. In order to check the extent of any memory problems that you might have, I meet with you to will carry out a brief assessment with you. I will use this score to help me to

PIS page 3



understand whether or not you can take part in the study, and will discuss this with you. Only individuals who manage to reach the required test score will proceed to the next stage of the research. Should you qualify, the researcher will make arrangements with you to try out using the assistive technology. You can ask a family member to be present with you if you wish. This process will require you to test telephone booking service which uses technology to guide you through the process. After completing, the researcher will ask you some questions based on your experience of using the service. This should take up to 1 hour.

What are the benefits of taking part?

There are no direct benefits to taking part in this study. However, many people enjoy or value being given an opportunity to take part in research that could benefit others in the future. The interview participants get an opportunity to try out assistive technology that others have found useful, which they might also find to be of benefit to them. We are carrying out this study to understand more about how we can help people with memory problems live more independently. If you take part you will be contributing in gaining understanding your thoughts on assistive technologies which might be used for future technology developments and how to make technologies more easily accessible to those who could benefit from them.

What are the possible risks of taking part?

We do not foresee or anticipate any significant risk to you in taking part in this study. The study does involve talking about what can be uncomfortable things. If, however, you feel uncomfortable at any time please let the researcher know and they will stop the appointment and check whether you are ok to carry on. If you would prefer to stop and withdraw from the study, you can do so at any time.

If you need any support during or after the interview then I will be able to put you in touch with a counselling service. I am also a registered estates manager with McCathy and Stone working in a retirement living development with experience of working with older people and I am happy to discuss the project with you should you wish to.

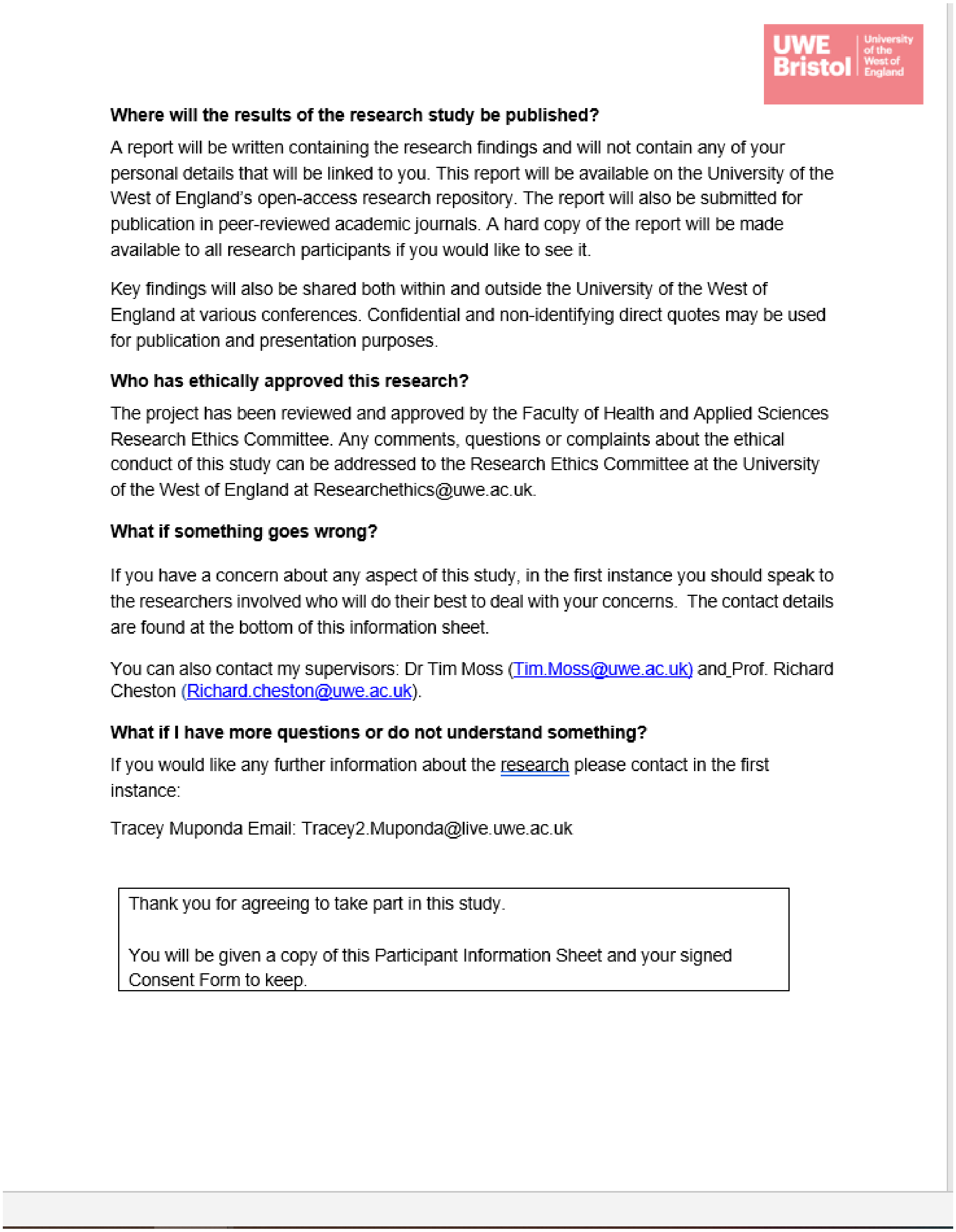
What will happen to your information?

All research material will be stored in a locked, password protected and secure setting to which only the researcher will have access in accordance with UWE requirements and also the Data Protection Act 2018 requirements. You can find more information about how we will use, store and process your data in the data privacy notice. All the information we receive from you will be treated in the strictest confidence.

Research material with identifiable information will be stored in a locked, password protected and secure setting to which only the researchers will have access in accordance with UWE requirements and also the Data Protection Act 2018 requirements.

Voice recordings will be safely deleted immediately after anonymised transcription. Your anonymised data will be analysed together with other interview and file data, and we will ensure that all information remains confidential and there is no way of tracing it to you.

PIS Page 4



Where will the results of the research study be published?

A report will be written containing the research findings and will not contain any of your personal details that will be linked to you. This report will be available on the University of the West of England's open-access research repository. The report will also be submitted for publication in peer-reviewed academic journals. A hard copy of the report will be made available to all research participants if you would like to see it.

Key findings will also be shared both within and outside the University of the West of England at various conferences. Confidential and non-identifying direct quotes may be used for publication and presentation purposes.

Who has ethically approved this research?

The project has been reviewed and approved by the Faculty of Health and Applied Sciences Research Ethics Committee. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England at Researchethics@uwe.ac.uk.

What if something goes wrong?

If you have a concern about any aspect of this study, in the first instance you should speak to the researchers involved who will do their best to deal with your concerns. The contact details are found at the bottom of this information sheet.

You can also contact my supervisors: Dr Tim Moss (Tim.Moss@uwe.ac.uk) and_Prof. Richard Cheston (Richard.cheston@uwe.ac.uk).

What if I have more questions or do not understand something?

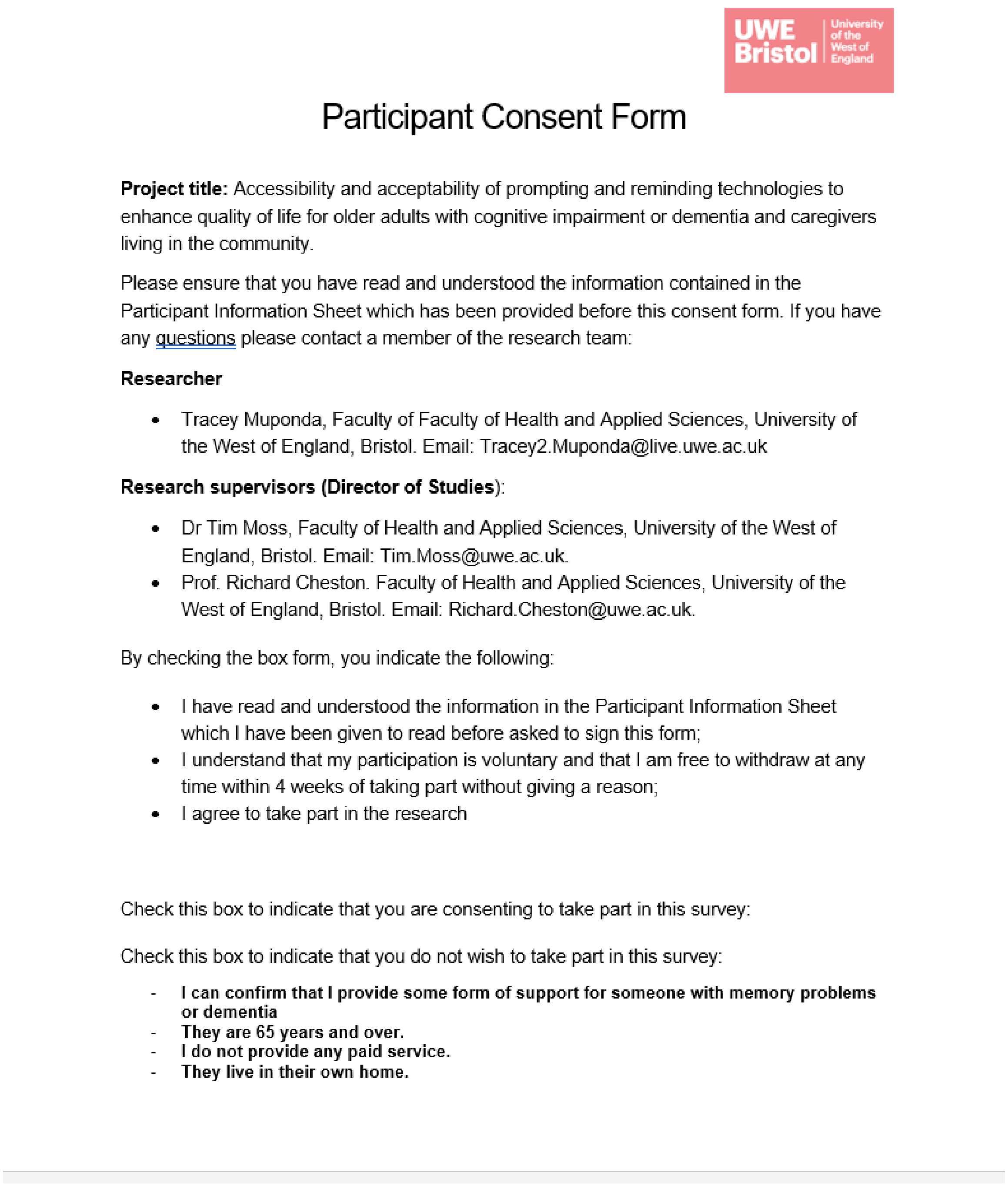
If you would like any further information about the research please contact in the first instance:

Tracey Muponda Email: Tracey2.Muponda@live.uwe.ac.uk

Thank you for agreeing to take part in this study.

You will be given a copy of this Participant Information Sheet and your signed Consent Form to keep.

Appendix 4: Consent from quantitative



Participant Consent Form

Project title: Accessibility and acceptability of prompting and reminding technologies to enhance quality of life for older adults with cognitive impairment or dementia and caregivers living in the community.

Please ensure that you have read and understood the information contained in the Participant Information Sheet which has been provided before this consent form. If you have any questions please contact a member of the research team:

Researcher

- Tracey Muponda, Faculty of Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Tracey2.Muponda@live.uwe.ac.uk

Research supervisors (Director of Studies):

- Dr Tim Moss, Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Tim.Moss@uwe.ac.uk.
- Prof. Richard Cheston. Faculty of Health and Applied Sciences, University of the West of England, Bristol. Email: Richard.Cheston@uwe.ac.uk.

By checking the box form, you indicate the following:

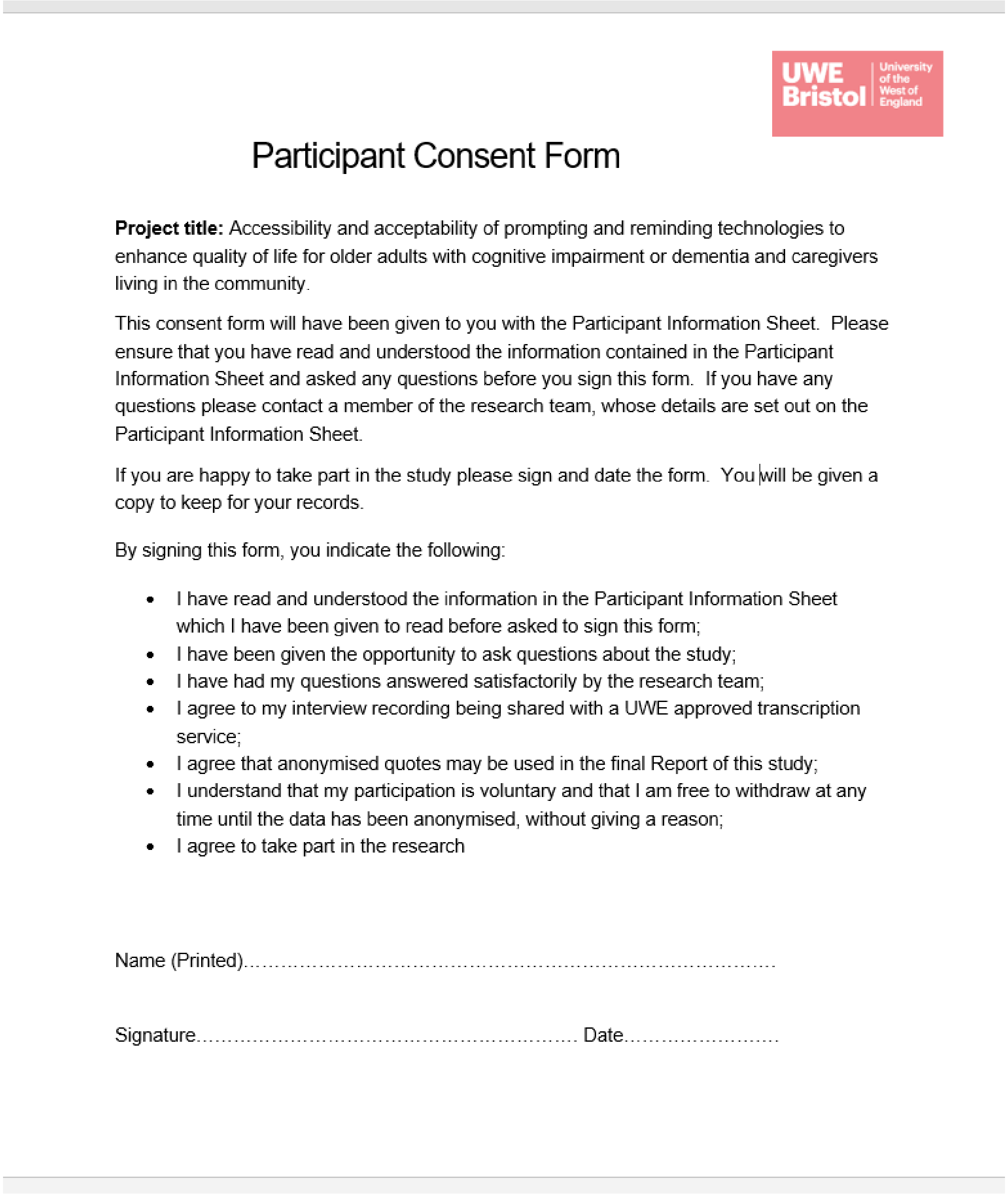
- I have read and understood the information in the Participant Information Sheet which I have been given to read before asked to sign this form;
- I understand that my participation is voluntary and that I am free to withdraw at any time within 4 weeks of taking part without giving a reason;
- I agree to take part in the research

Check this box to indicate that you are consenting to take part in this survey:

Check this box to indicate that you do not wish to take part in this survey:

- **I can confirm that I provide some form of support for someone with memory problems or dementia**
- **They are 65 years and over.**
- **I do not provide any paid service.**
- **They live in their own home.**

APPENDIX 5: Consent Form qualitative



Participant Consent Form

Project title: Accessibility and acceptability of prompting and reminding technologies to enhance quality of life for older adults with cognitive impairment or dementia and caregivers living in the community.

This consent form will have been given to you with the Participant Information Sheet. Please ensure that you have read and understood the information contained in the Participant Information Sheet and asked any questions before you sign this form. If you have any questions please contact a member of the research team, whose details are set out on the Participant Information Sheet.

If you are happy to take part in the study please sign and date the form. You will be given a copy to keep for your records.

By signing this form, you indicate the following:

- I have read and understood the information in the Participant Information Sheet which I have been given to read before asked to sign this form;
- I have been given the opportunity to ask questions about the study;
- I have had my questions answered satisfactorily by the research team;
- I agree to my interview recording being shared with a UWE approved transcription service;
- I agree that anonymised quotes may be used in the final Report of this study;
- I understand that my participation is voluntary and that I am free to withdraw at any time until the data has been anonymised, without giving a reason;
- I agree to take part in the research

Name (Printed)……………………………………………………………………………

Signature………………………………………………………… Date……………………..

Appendix 7: Participant social media invite

Volunteer research participants needed

My name is Tracey Muponda. I'm looking for people who look after someone over 65 years living with dementia or who has problems remembering things. This is a research study for my Health Psychology doctoral thesis with the University of the West of England.

If you are interested in taking part, please use the link below to access more details about the research. Thank you.

https://uwe.eu.qualtrics.com/jfe/form/SV_3wpiuRhNGFFvTUh

APPENDIX 8: Clinical Dementia Rating (CDR)

The CDR scale is used in staging dementia and evaluates cognitive, behavioural, and functional aspects of dementia. This scale has been found to be reliable when applied in non-clinical settings with non-medical personnel to determine the stage of dementia (Chaves et al., 2007; Yang et al., 2021). It consists of six domains of cognitive and functional performance: Memory, Orientation, Judgment & Problem Solving, Community Affairs, Home & Hobbies, and Personal Care. The ratings are based on a 5-point scale (0, 0.5, 1, 2, 3) on each domain except Personal Care which is rated on a 4-point scale (0,1,2,3). The overall score is derived by standard algorithm which is useful for globally staging the level of impairment: 0 = No impairment, 0.5, 1, 2, and 3 indicate Very Mild, Mild, Moderate and Severe Dementia (Morris, 1993).

Memory: “No memory loss or slight inconsistent forgetfulness”, “Consistent slight forgetfulness; partial recollection of events; “benign” forgetfulness”, “Moderate memory loss; more marked for recent events; defect interferes with everyday activities”, “Severe memory loss; only highly learned material retained; new material rapidly lost”, “Severe memory loss; only fragments remain”.

Orientation: “Fully oriented”, “Fully oriented except for slight difficulty with time relationships”, “Moderate difficulty with time relationships; oriented to place of examination; may have geographic disorientation elsewhere”, “Severe difficulty with time relationships; usually disoriented to time, often to place”, “ Oriented to person only”.

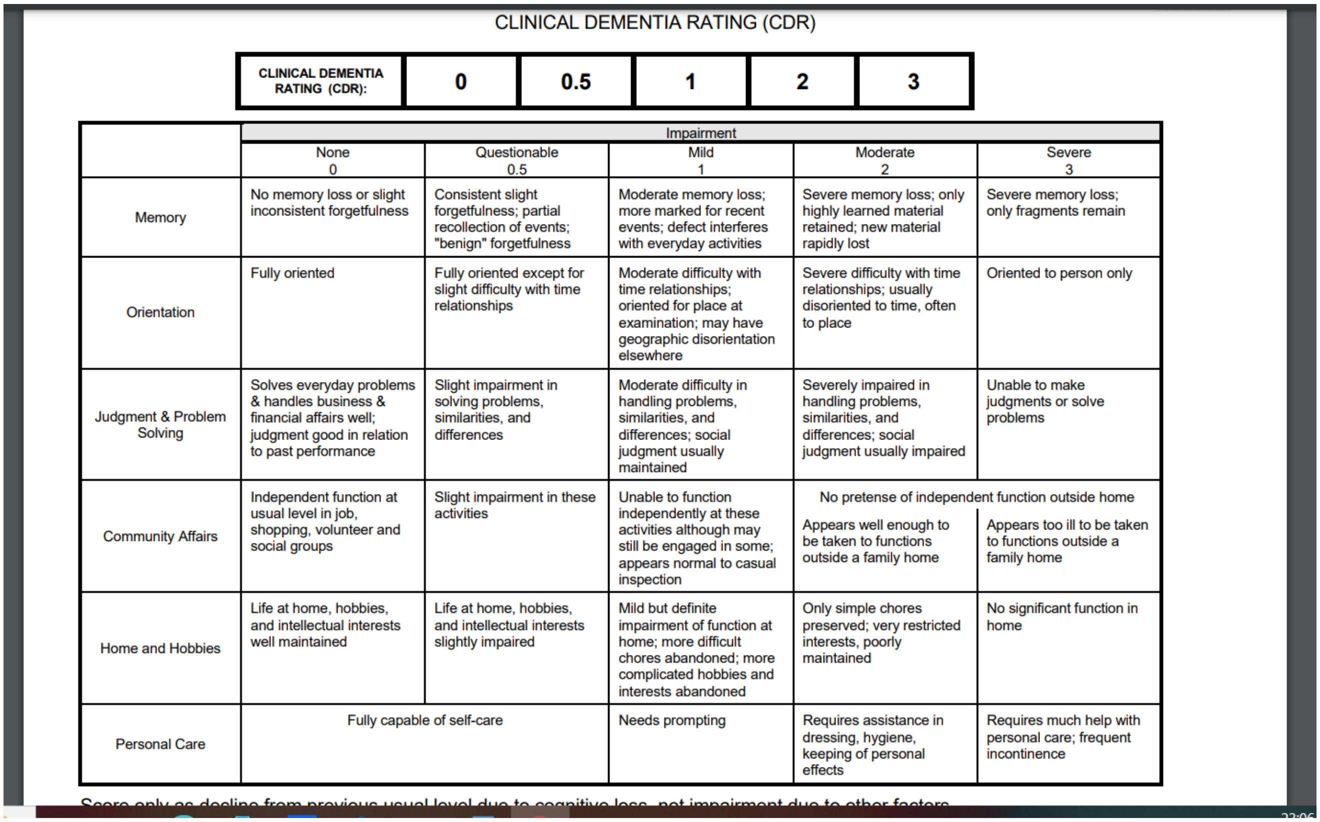
Judgment and problem solving: “Solves everyday problems and handles business and financial affairs well; judgement good in relation to past performances”, “Slight impairment in solving problems, similarities and differences”, “Moderate difficulty in handling problems, similarities and differences; social judgement usually maintained”, “Severely impaired in handling problems, similarities and differences; social judgement usually impaired”, “Unable to make judgements or solve problems”.

Community affairs: “Independently perform at usual level in job, shopping, volunteer and social groups”, “Slight impairment in these activities”, “Unable to perform independently at these activities although may still be engaged in some; appears normal to casual inspection”, “Appears well enough to be taken to activities outside the family home”, “Appears too ill to be taken to activities outside the family home”.

Home and hobbies: “Life at home, hobbies and intellectual interests well maintained “, “Life at home, hobbies and intellectual interest slightly impaired”, “Mild but definite impairment of operating at home more difficult tasks abandoned; more complicated hobbies and interests abandoned”, “Only simple tasks preserved; very restricted interests, poorly maintained “, “No significant activities at home”

Personal care: “Fully capable of self-care”, “Needs prompting”, “Requires assistance in dressing, hygiene, keeping of personal effects”, “Requires much help with personal care; frequent incontinence”.

CDR worksheet



CLINICAL DEMENTIA RATING (CDR)

CLINICAL DEMENTIA RATING (CDR):	0	0.5	1	2	3

	Impairment				
	None 0	Questionable 0.5	Mild 1	Moderate 2	Severe 3
Memory	No memory loss or slight inconsistent forgetfulness	Consistent slight forgetfulness; partial recollection of events; "benign" forgetfulness	Moderate memory loss; more marked for recent events; defect interferes with everyday activities	Severe memory loss; only highly learned material retained; new material rapidly lost	Severe memory loss; only fragments remain
Orientation	Fully oriented	Fully oriented except for slight difficulty with time relationships	Moderate difficulty with time relationships; oriented for place at examination; may have geographic disorientation elsewhere	Severe difficulty with time relationships; usually disoriented to time, often to place	Oriented to person only
Judgment & Problem Solving	Solves everyday problems & handles business & financial affairs well; judgment good in relation to past performance	Slight impairment in solving problems, similarities, and differences	Moderate difficulty in handling problems, similarities, and differences; social judgment usually maintained	Severely impaired in handling problems, similarities, and differences; social judgment usually impaired	Unable to make judgments or solve problems
Community Affairs	Independent function at usual level in job, shopping, volunteer and social groups	Slight impairment in these activities	Unable to function independently at these activities although may still be engaged in some; appears normal to casual inspection	No pretense of independent function outside home Appears well enough to be taken to functions outside a family home	Appears too ill to be taken to functions outside a family home
Home and Hobbies	Life at home, hobbies, and intellectual interests well maintained	Life at home, hobbies, and intellectual interests slightly impaired	Mild but definite impairment of function at home; more difficult chores abandoned; more complicated hobbies and interests abandoned	Only simple chores preserved; very restricted interests, poorly maintained	No significant function in home
Personal Care	Fully capable of self-care		Needs prompting	Requires assistance in dressing, hygiene, keeping of personal effects	Requires much help with personal care; frequent incontinence

Score only as decline from previous usual level due to cognitive loss, not impairment due to other factors.

APPENDIX 9: Technology Acceptance Model (TAM) scale

The TAM scale has been used to evaluate people's attitudes towards technology and their likeliness to accept using it. The survey items include perceived usefulness (PU), perceived ease of use (PEOU), attitude (A), and intention to use (IOU). The questionnaire was adapted to the context of this study and is based on the constructs validated by Davis (1989). The questionnaire has been used and validated in previous studies showing reliability across the items and having strong predictive capabilities. This questionnaire consists of seven items rated on a 5-point scale (1 'agree very strongly' to 5 'disagree very strongly'). Each domain consisted of a possible a minimum score of 5 and maximum of 20.

PU: "Using this type of memory aid device would increase the person I support's ability to manage their daily task", "The person I support would find this type of memory aid device useful in his/her daily activities", "Using this type of memory aid device would make it easier for the person I support to keep on track with some daily activities", "Using this type of memory aid device would improve the person I support's quality of life".

PEOU: "I think the person I support would find it easy to follow this type of memory aid device to manage her/his daily activities", "I think the person I support would find it easy to follow this type of memory aid device to achieve specific tasks on their own", "I think the person I support would find this type of memory aid device clear and understandable to use", "I think the person I support would find it easy to become skilful at using this type of memory aid device as a guide to get it to do what she/he wants it to do".

ATT: "I think it is a good idea for the person I support to use this type of memory aid device to enable more independence", "think it would be beneficial for the person I support to use this type of memory aid device", "I think using this type of memory aid device would be a positive influence for the person I support", "I think this type of memory aid device would be valuable for the person I support".

IOU: "I think the person I support would love to use this type of memory aid device", "I intend to encourage the person I support to use this type of memory aid device", "I intend to support the person I support to use this type of memory aid device", "I have intentions of learning to use this type of memory aid device in order to assist the person I support".

APPENDIX 10: Short Sense of competence questionnaire

Consequences of involvement in care for the personal life of the caregiver

- I feel that my present situation with my..doesn’t allow me as much privacy as I’d like
- I feel stressed between trying to give to my.. as well as to other family responsibilities, job etc.

Satisfaction with one’s own performance as a caregiver

- I wish that my..and I had a better relationship.
- In feel strained in my interactions with my…

Satisfaction with the demented person as a recipient of care

- I feel that my ..behaves the way s/he does to have her/his own way.
- I feel that my.. behaves the way s/he does to annoy me.
- I feel that my..tries to manipulate me.

Answer categories:

1= Yes! (agree very strongly)

2= Yes (agree)

3= Yes/No (neutral)

4= No (disagree)

5= No! (disagree very strongly)

Appendix 12 - UWE Ethics Approval

UWE Bristol University of the West of England

Faculty of Health & Applied Sciences
Glenside Campus
Blackberry Hill
Stapleton
Bristol BS16 1DD

Tel: 0117 328 1170

UWE REC REF No: HAS.20.08.013

25th November 2020

Tracey Muponda

Dear Tracey

Application title: Accessibility and acceptability of prompting and reminding technologies to enhance quality of life for older adults with cognitive impairment or dementia and caregivers living in the community

Thank you for responding to the conditions raised in my letter to you on the 2nd October 2020.

I can now confirm full ethics approval for your project, but please note the proviso below.

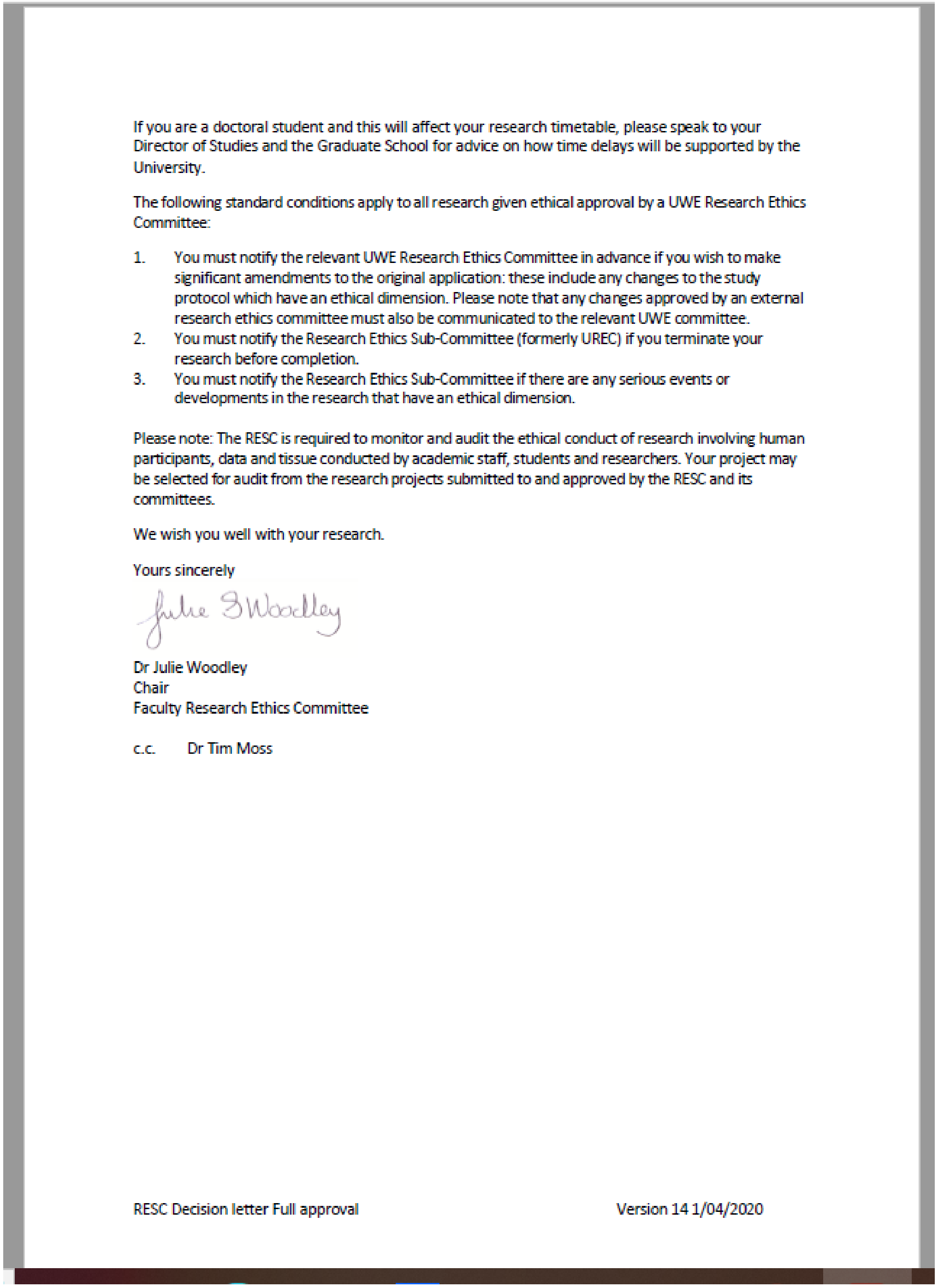
Please note: In light of the current situation regarding COVID-19, we can only authorise an immediate start for activities that do not breach either national laws or University policies (for further information please click on the following link https://intranet.uwe.ac.uk/tasks-guides/Guide/research-and-enterprise-covid-19-information#part1). In these uncertain times, law and policy may change swiftly and frequently.

We are, however, continuing to scrutinise and grant ethical approval for activities that cannot take place at present, to ensure that once the situation changes and activities can go ahead, the research is not unnecessarily delayed.

What this means for your application:

1. If your application DOES NOT involve activities affected by the current crisis (e.g. online surveys or telephone interviews etc.) then you may start your research as soon as you receive this formal notification of your ethical approval;
2. If your application DOES involve activities affected by the current crisis then you must not start your research until you are lawfully and safely able to do so, and when it does not breach the University's policies. This will affect the dates you have supplied on your application form in relation to start and finish. When you have new dates, please can you write to us in order that we can add this information to your file?

RESC Decision letter Full approval Version 14 1/04/2020



If you are a doctoral student and this will affect your research timetable, please speak to your Director of Studies and the Graduate School for advice on how time delays will be supported by the University.

The following standard conditions apply to all research given ethical approval by a UWE Research Ethics Committee:

1. You must notify the relevant UWE Research Ethics Committee in advance if you wish to make significant amendments to the original application: these include any changes to the study protocol which have an ethical dimension. Please note that any changes approved by an external research ethics committee must also be communicated to the relevant UWE committee.
2. You must notify the Research Ethics Sub-Committee (formerly UREC) if you terminate your research before completion.
3. You must notify the Research Ethics Sub-Committee if there are any serious events or developments in the research that have an ethical dimension.

Please note: The RESC is required to monitor and audit the ethical conduct of research involving human participants, data and tissue conducted by academic staff, students and researchers. Your project may be selected for audit from the research projects submitted to and approved by the RESC and its committees.

We wish you well with your research.

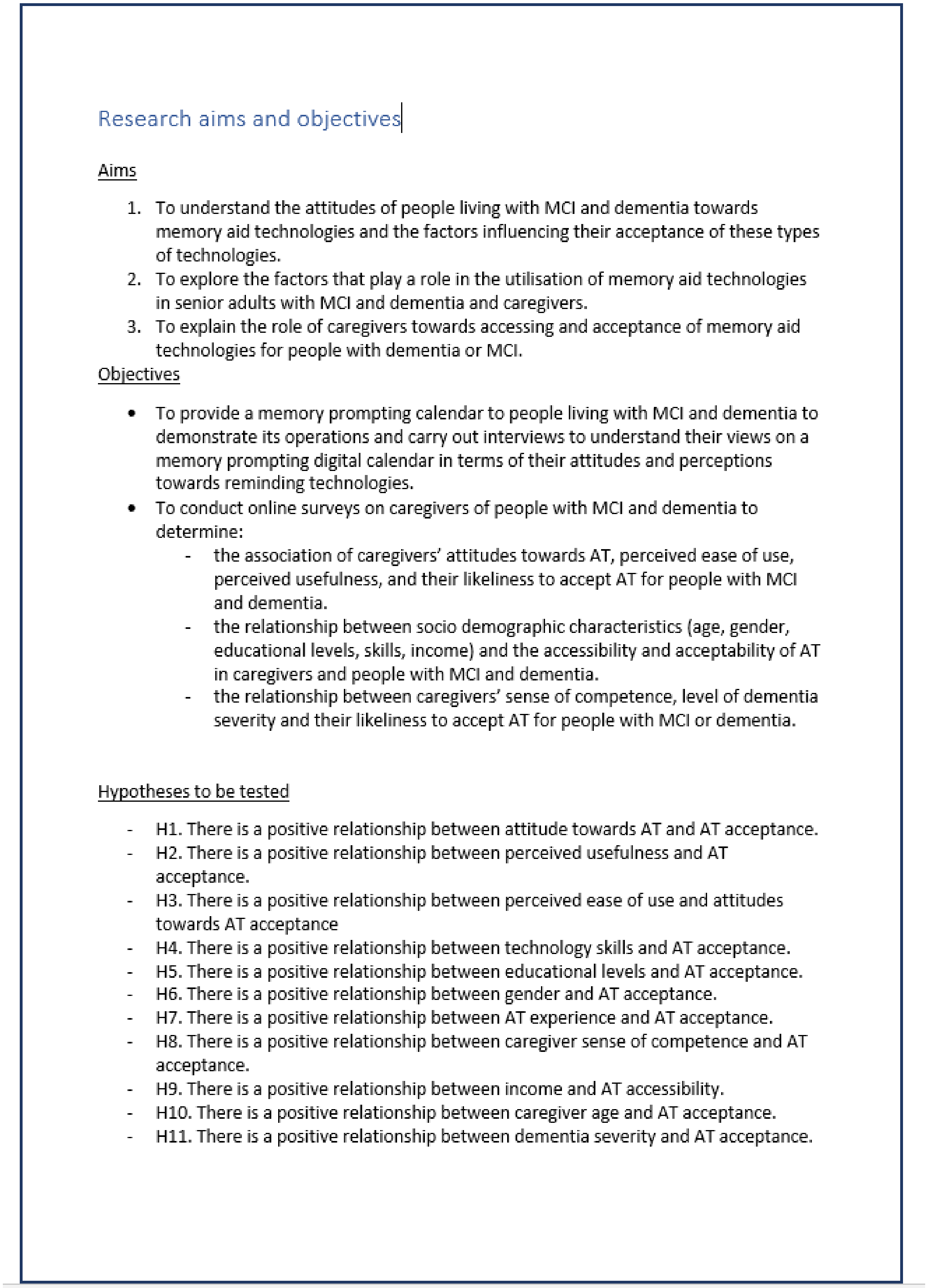
Yours sincerely

Julie S Woodley

Dr Julie Woodley
Chair
Faculty Research Ethics Committee

c.c. Dr Tim Moss

APPENDIX 13 Data Analysis Plan



Research aims and objectives

Aims

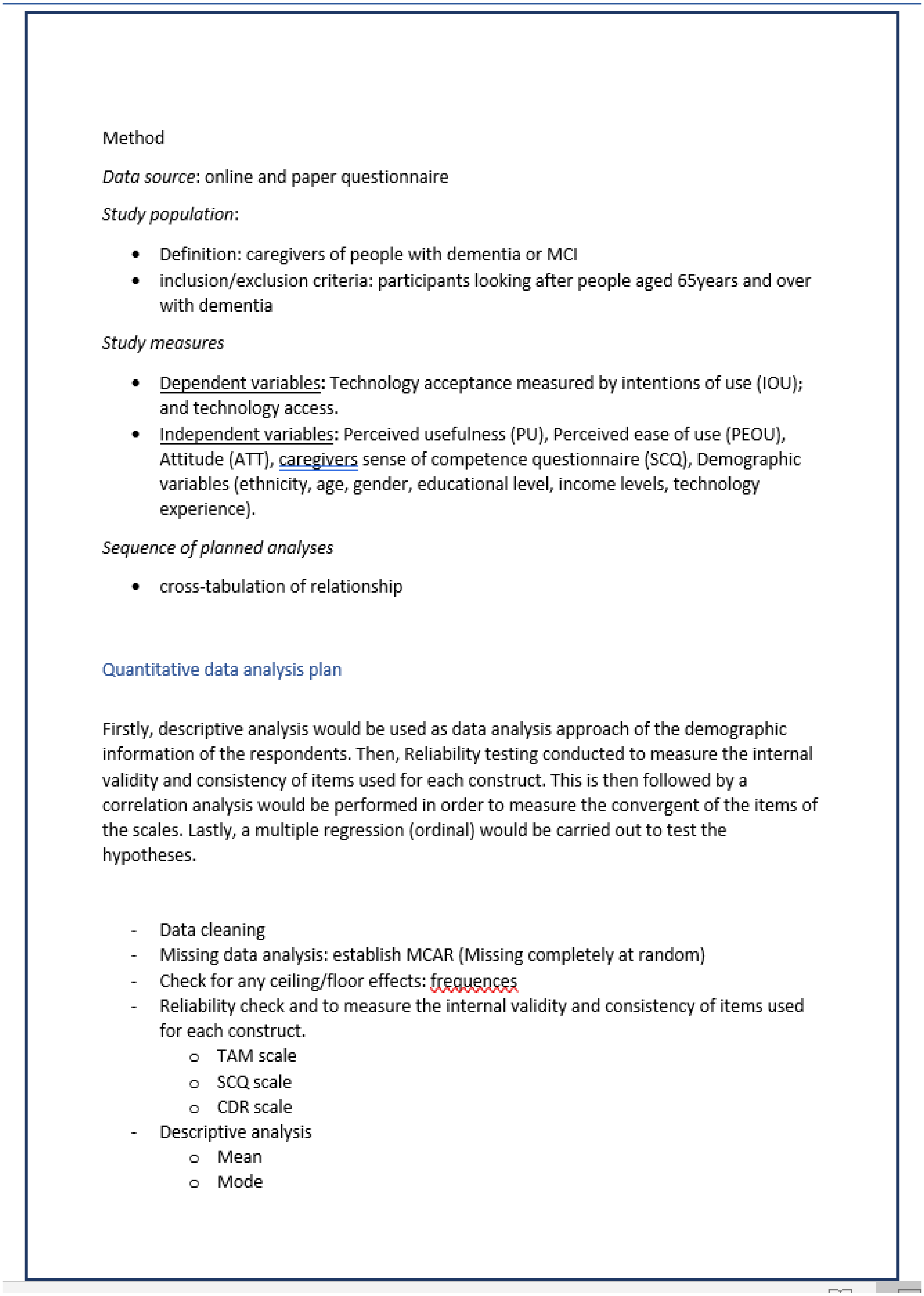
1. To understand the attitudes of people living with MCI and dementia towards memory aid technologies and the factors influencing their acceptance of these types of technologies.
2. To explore the factors that play a role in the utilisation of memory aid technologies in senior adults with MCI and dementia and caregivers.
3. To explain the role of caregivers towards accessing and acceptance of memory aid technologies for people with dementia or MCI.

Objectives

- To provide a memory prompting calendar to people living with MCI and dementia to demonstrate its operations and carry out interviews to understand their views on a memory prompting digital calendar in terms of their attitudes and perceptions towards reminding technologies.
- To conduct online surveys on caregivers of people with MCI and dementia to determine:
    - the association of caregivers' attitudes towards AT, perceived ease of use, perceived usefulness, and their likeliness to accept AT for people with MCI and dementia.
    - the relationship between socio demographic characteristics (age, gender, educational levels, skills, income) and the accessibility and acceptability of AT in caregivers and people with MCI and dementia.
    - the relationship between caregivers' sense of competence, level of dementia severity and their likeliness to accept AT for people with MCI or dementia.

Hypotheses to be tested

- H1. There is a positive relationship between attitude towards AT and AT acceptance.
- H2. There is a positive relationship between perceived usefulness and AT acceptance.
- H3. There is a positive relationship between perceived ease of use and attitudes towards AT acceptance
- H4. There is a positive relationship between technology skills and AT acceptance.
- H5. There is a positive relationship between educational levels and AT acceptance.
- H6. There is a positive relationship between gender and AT acceptance.
- H7. There is a positive relationship between AT experience and AT acceptance.
- H8. There is a positive relationship between caregiver sense of competence and AT acceptance.
- H9. There is a positive relationship between income and AT accessibility.
- H10. There is a positive relationship between caregiver age and AT acceptance.
- H11. There is a positive relationship between dementia severity and AT acceptance.



Method

Data source: online and paper questionnaire

Study population:

- Definition: caregivers of people with dementia or MCI
- inclusion/exclusion criteria: participants looking after people aged 65years and over with dementia

Study measures

- Dependent variables**:** Technology acceptance measured by intentions of use (IOU); and technology access.
- Independent variables**:** Perceived usefulness (PU), Perceived ease of use (PEOU), Attitude (ATT), caregivers sense of competence questionnaire (SCQ), Demographic variables (ethnicity, age, gender, educational level, income levels, technology experience).

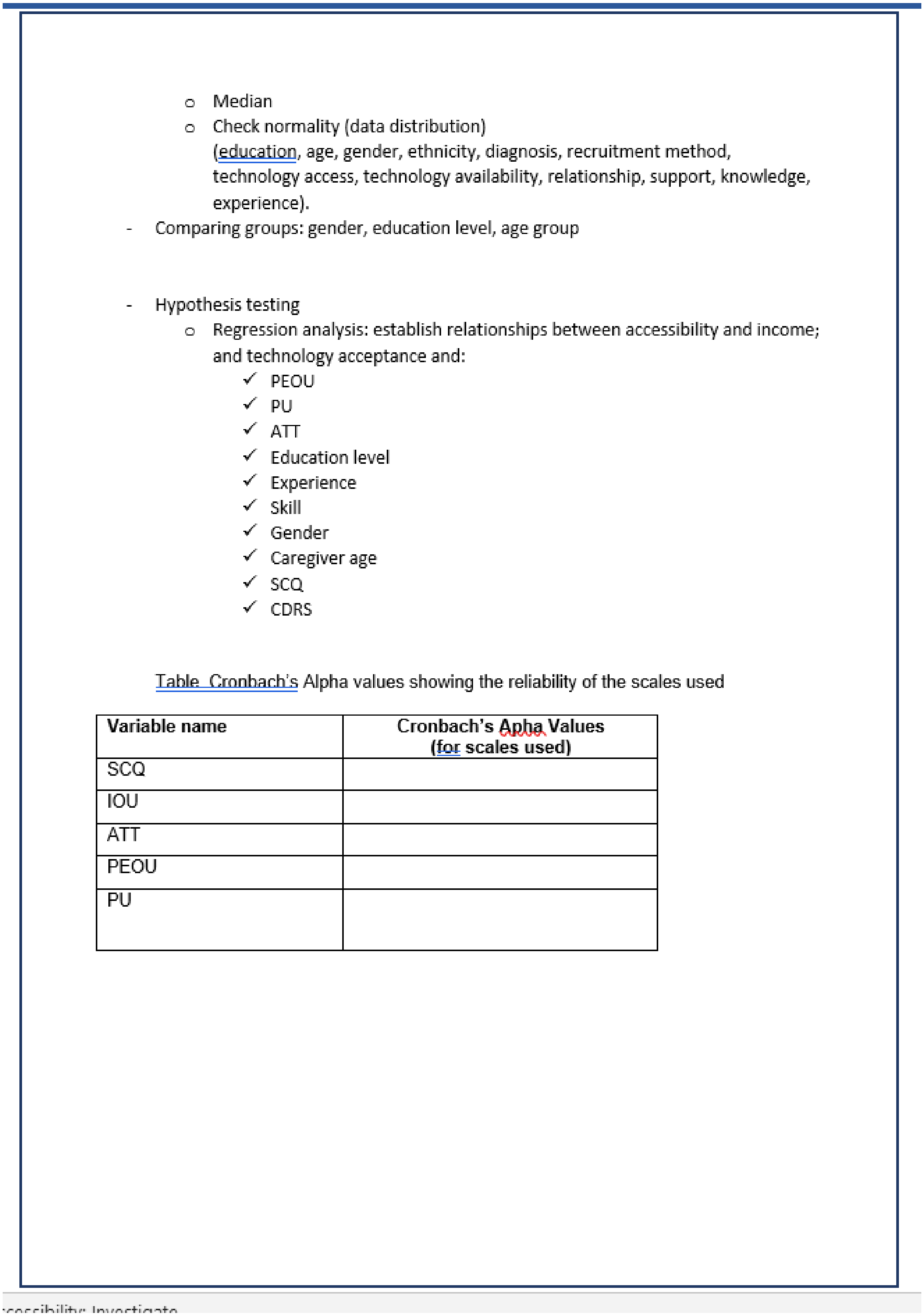
Sequence of planned analyses

- cross-tabulation of relationship

Quantitative data analysis plan

Firstly, descriptive analysis would be used as data analysis approach of the demographic information of the respondents. Then, Reliability testing conducted to measure the internal validity and consistency of items used for each construct. This is then followed by a correlation analysis would be performed in order to measure the convergent of the items of the scales. Lastly, a multiple regression (ordinal) would be carried out to test the hypotheses.

- Data cleaning
- Missing data analysis: establish MCAR (Missing completely at random)
- Check for any ceiling/floor effects: frequences
- Reliability check and to measure the internal validity and consistency of items used for each construct.
    - TAM scale
    - SCQ scale
    - CDR scale
- Descriptive analysis
    - Mean
    - Mode

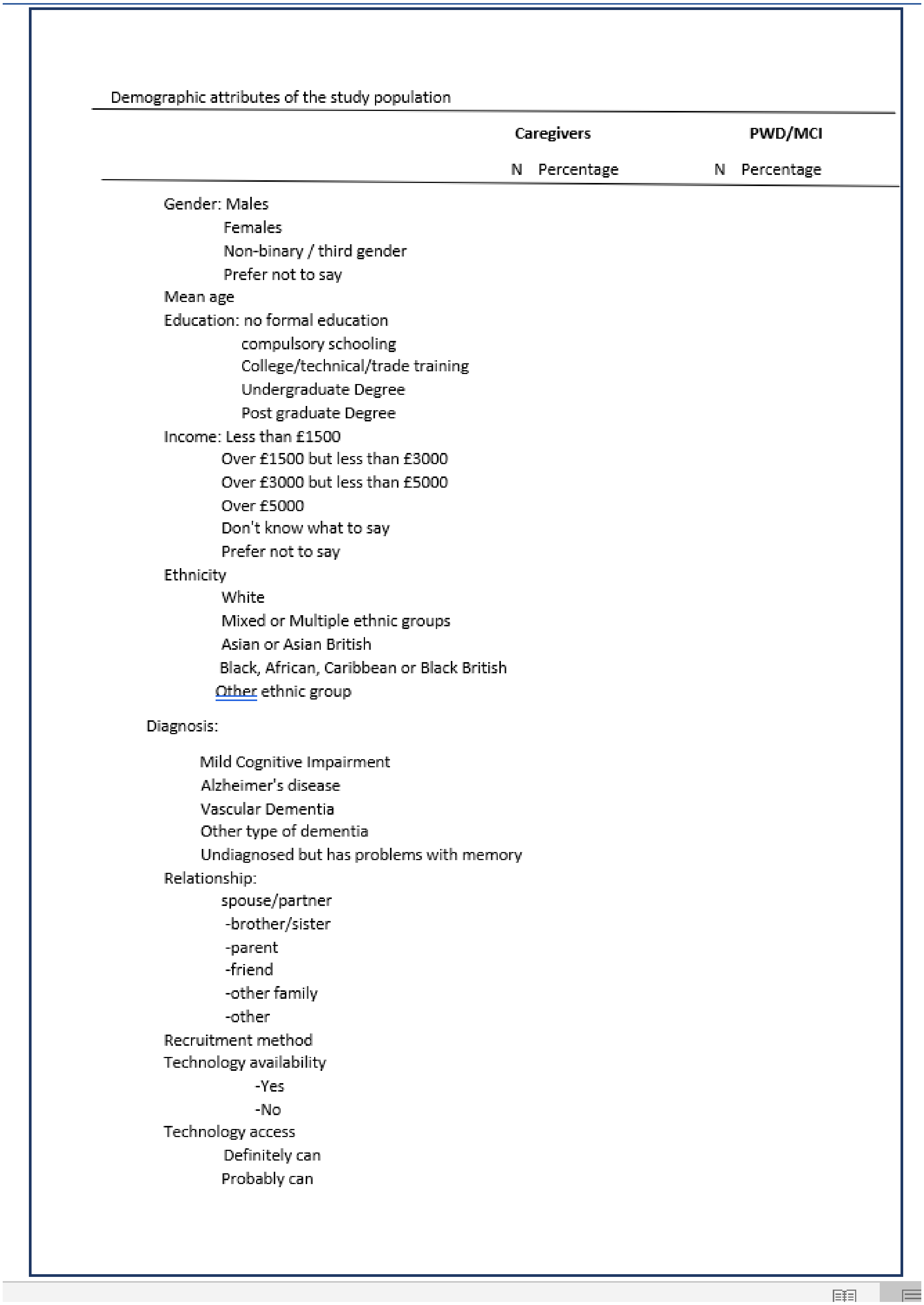


    - Median
    - Check normality (data distribution) (education, age, gender, ethnicity, diagnosis, recruitment method, technology access, technology availability, relationship, support, knowledge, experience).
- Comparing groups: gender, education level, age group

- Hypothesis testing
    - Regression analysis: establish relationships between accessibility and income; and technology acceptance and:
        - ✓ PEOU
        - ✓ PU
        - ✓ ATT
        - ✓ Education level
        - ✓ Experience
        - ✓ Skill
        - ✓ Gender
        - ✓ Caregiver age
        - ✓ SCQ
        - ✓ CDRS

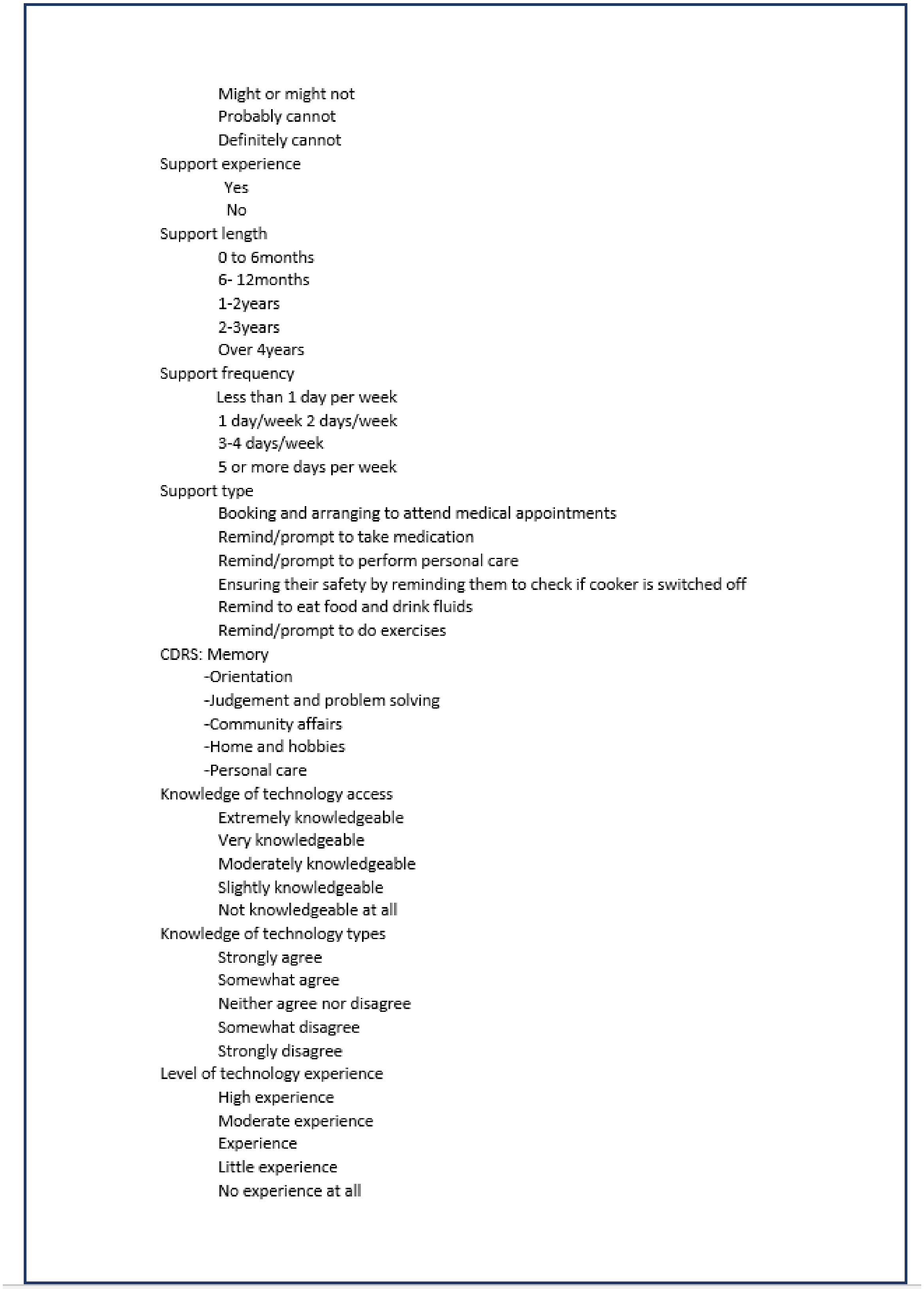
Table Cronbach's Alpha values showing the reliability of the scales used

Variable name	**Cronbach's Apha Values (for scales used)**
SCQ	
IOU	
ATT	
PEOU	
PU	



Demographic attributes of the study population

	Caregivers		PWD/MCI	
	N	Percentage	N	Percentage
Gender: Males				
Females				
Non-binary / third gender				
Prefer not to say				
Mean age				
Education: no formal education				
compulsory schooling				
College/technical/trade training				
Undergraduate Degree				
Post graduate Degree				
Income: Less than £1500				
Over £1500 but less than £3000				
Over £3000 but less than £5000				
Over £5000				
Don't know what to say				
Prefer not to say				
Ethnicity				
White				
Mixed or Multiple ethnic groups				
Asian or Asian British				
Black, African, Caribbean or Black British				
Other ethnic group				
Diagnosis:				
Mild Cognitive Impairment				
Alzheimer's disease				
Vascular Dementia				
Other type of dementia				
Undiagnosed but has problems with memory				
Relationship:				
spouse/partner				
-brother/sister				
-parent				
-friend				
-other family				
-other				
Recruitment method				
Technology availability				
-Yes				
-No				
Technology access				
Definitely can				
Probably can				



- Might or might not
- Probably cannot
- Definitely cannot

Support experience
- Yes
- No

Support length
- 0 to 6months
- 6- 12months
- 1-2years
- 2-3years
- Over 4years

Support frequency
- Less than 1 day per week
- 1 day/week 2 days/week
- 3-4 days/week
- 5 or more days per week

Support type
- Booking and arranging to attend medical appointments
- Remind/prompt to take medication
- Remind/prompt to perform personal care
- Ensuring their safety by reminding them to check if cooker is switched off
- Remind to eat food and drink fluids
- Remind/prompt to do exercises

CDRS: Memory
-Orientation
-Judgement and problem solving
-Community affairs
-Home and hobbies
-Personal care

Knowledge of technology access
- Extremely knowledgeable
- Very knowledgeable
- Moderately knowledgeable
- Slightly knowledgeable
- Not knowledgeable at all

Knowledge of technology types
- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Level of technology experience
- High experience
- Moderate experience
- Experience
- Little experience
- No experience at all

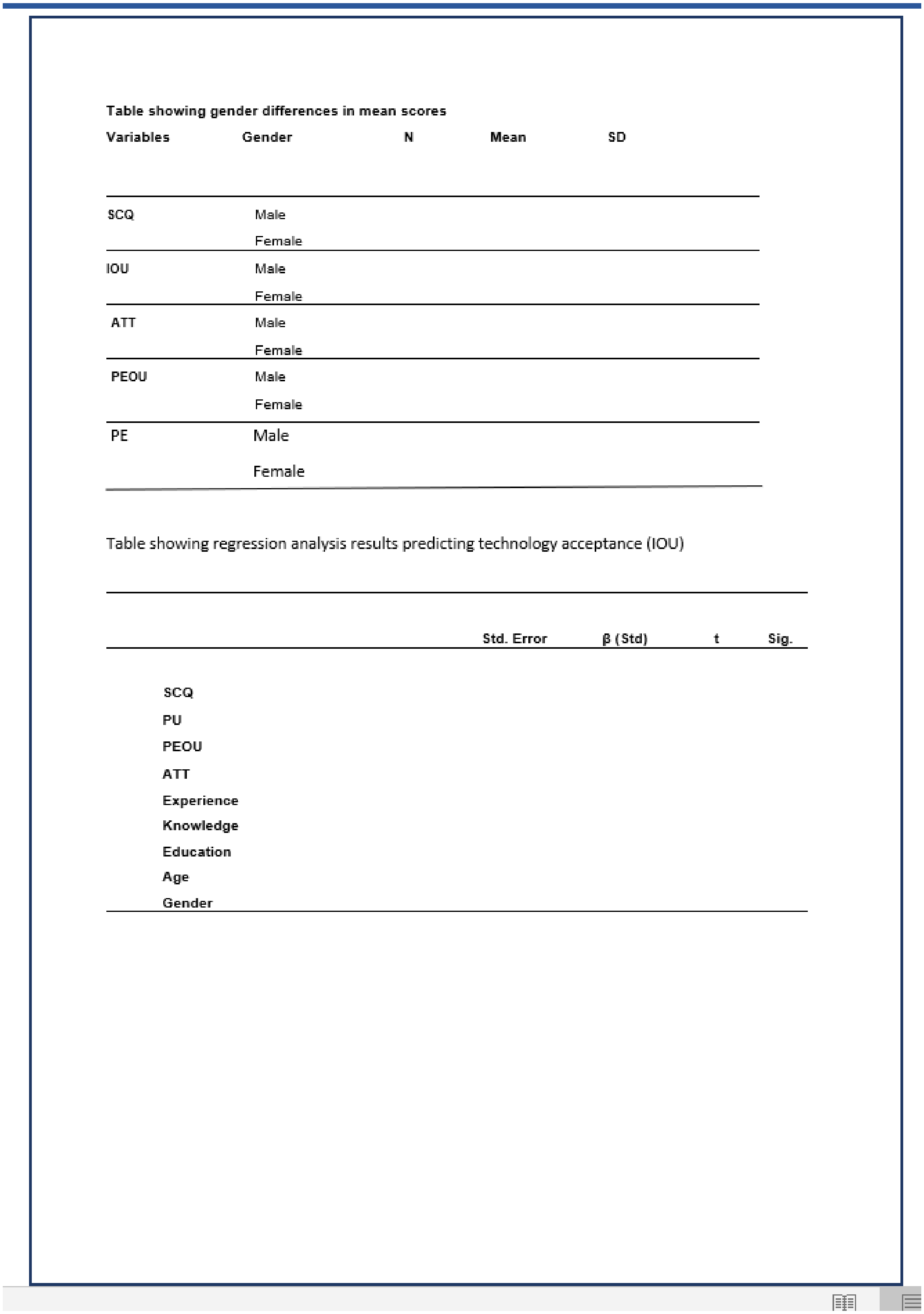


Table showing gender differences in mean scores

Variables	Gender	N	Mean	SD
SCQ	Male			
	Female			
IOU	Male			
	Female			
ATT	Male			
	Female			
PEOU	Male			
	Female			
PE	Male			
	Female			

Table showing regression analysis results predicting technology acceptance (IOU)

	Std. Error	β (Std)	t	Sig.
SCQ				
PU				
PEOU				
ATT				
Experience				
Knowledge				
Education				
Age				
Gender				

APPENDIX: 14 Interview transcript example

My daughters thought that you made a difficult choice by picking me.

Can you tell me your views over this technology?

I think it’s helpful, I think its fine, I think the problem is the people of my age would find it quite difficult to reconcile themselves to understand the technology. For instance, if I wanted to contact you, I’ve seen an email, well I don’t do emails.... Well, I do text family and daughters or phone them. As you can see my phone is a complete it’s an old it’s not a smart phone it’s a decent very simple old phone which my grandson bought for me, but I find that it’s all I need.

I can see that you have a basic phone, but you also have an iPad, what do you use your iPad for?

Well, I use it for the sports results or I’ll be looking at the weather focus. If I want any information anything at all you can get everything there, these are the reasons I use it you know.

Every day I look at it for the weather also I got for the fourteen day local focus it’s very accurate and I get the cricket results and the ___ results because I’m very interested in that. So that’s it, I look for all sort of things on the or you or maybe I want to cheat on the cross word or anything that I need information about, its all in there its wonderful. So that’s basically what I use it for.

What made you to start using an iPad?

My grandson they bought me one and my daughters bought me one, and I call him Mr M, he came around set it all up and time. And occasionally I’ve had problems and would ask for him, she tells him and he says: What has he done now? He says you know .... I knew what I would use it for and found it use out of it and pleasure out of it and satisfaction out of it you know.

So do you use it for reminders or prompters?

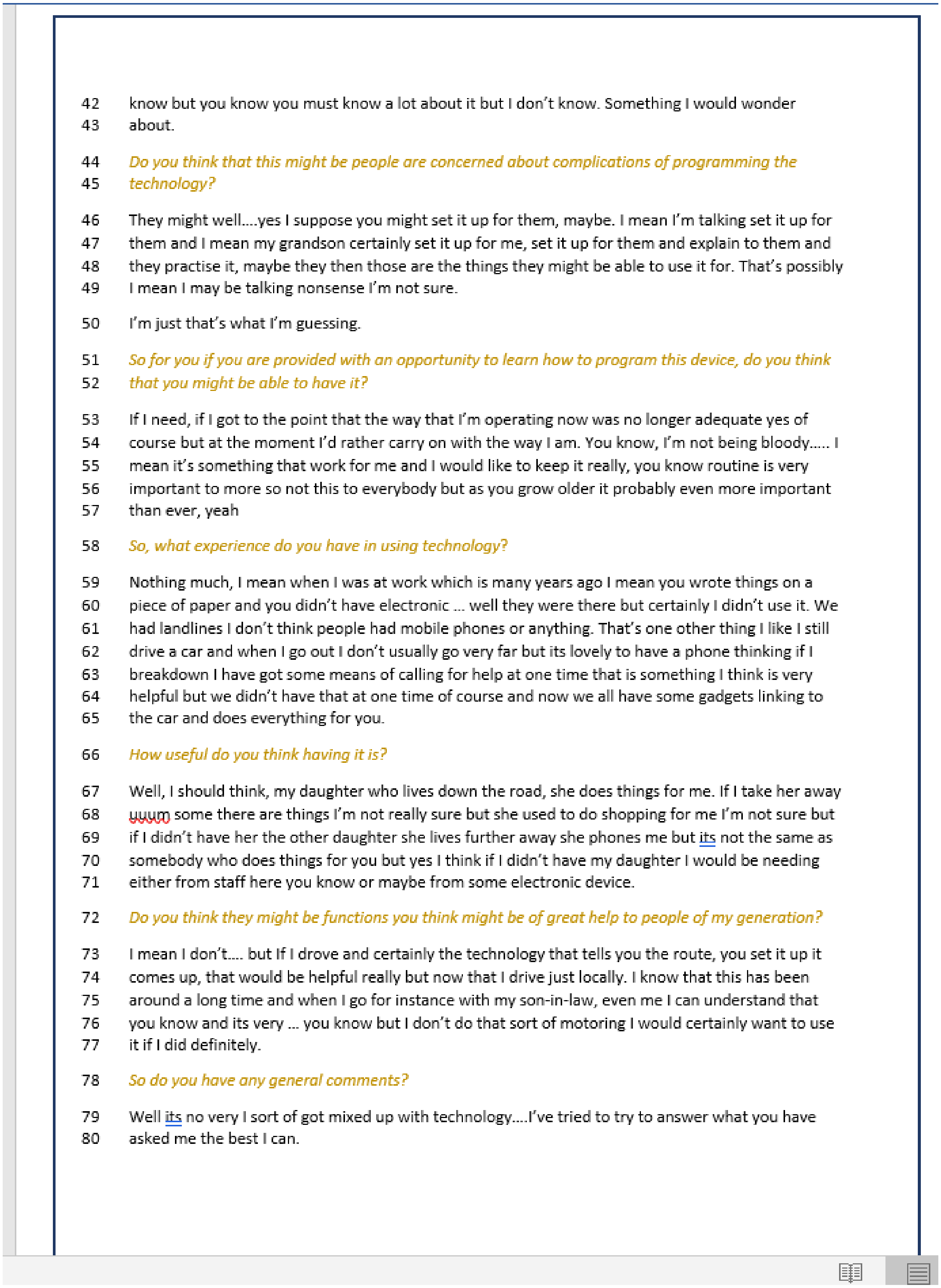
No... to be honest, I don’t need that because I’ve got sort of routine, I’ve got a diary for my appointments which I look at every day and my medication I always take some after breakfast and one after lunch and I do it sort of everyday and I never.... I’ll tell you one thing that I would find need a reminder useful I have to wear this (he shows me the pendant) after when I go out sometime I take it off and I hang it on the, I’ve got a key pad there (the pendant?), yes. And when I come back, I could be in for a while and I think C I haven’t put my thing .... Its one thing that I occasionally well I forget. If it something maybe if there was something that said, have you got your .... (Pendant?) on... that would be useful. The only thing I can only say is I’ll never mistake my medication, it’s a question of routine, isn’t it? And at the moment I’m able to cope with things.

What are your thoughts over a digital calendar what is your likeliness to having it?

To be honest I’m so got used that diary over there, I’ll like to keep my routine now maybe one day then it would be useful but I would like to stick the routine I’ve got because it works you know. Is that ok?

Lets talk about people with memory problems, in your views what are the chances for them to accept this type of technology?

As long as they can actually understand the complications of it, I’m sure it would be helpful to them but I’m not sure how easy they would find if they have already lost quite a lot of uuum... there’s quite a lot of people I can think of here who are very vague. Well, we sat with one block, the block he said that he doesn’t sort of know what’s going on really. I said why are you coming to the garden party he said I don’t know that sort of thing. People like that you know they might I don’t know whether they would be able to understand technologies without the simplicities, I mean I just don’t



know but you know you must know a lot about it but I don't know. Something I would wonder about.

Do you think that this might be people are concerned about complications of programming the technology?

They might well….yes I suppose you might set it up for them, maybe. I mean I'm talking set it up for them and I mean my grandson certainly set it up for me, set it up for them and explain to them and they practise it, maybe they then those are the things they might be able to use it for. That's possibly I mean I may be talking nonsense I'm not sure.

I'm just that's what I'm guessing.

So for you if you are provided with an opportunity to learn how to program this device, do you think that you might be able to have it?

If I need, if I got to the point that the way that I'm operating now was no longer adequate yes of course but at the moment I'd rather carry on with the way I am. You know, I'm not being bloody….. I mean it's something that work for me and I would like to keep it really, you know routine is very important to more so not this to everybody but as you grow older it probably even more important than ever, yeah

So, what experience do you have in using technology?

Nothing much, I mean when I was at work which is many years ago I mean you wrote things on a piece of paper and you didn't have electronic … well they were there but certainly I didn't use it. We had landlines I don't think people had mobile phones or anything. That's one other thing I like I still drive a car and when I go out I don't usually go very far but its lovely to have a phone thinking if I breakdown I have got some means of calling for help at one time that is something I think is very helpful but we didn't have that at one time of course and now we all have some gadgets linking to the car and does everything for you.

How useful do you think having it is?

Well, I should think, my daughter who lives down the road, she does things for me. If I take her away uuum some there are things I'm not really sure but she used to do shopping for me I'm not sure but if I didn't have her the other daughter she lives further away she phones me but its not the same as somebody who does things for you but yes I think if I didn't have my daughter I would be needing either from staff here you know or maybe from some electronic device.

Do you think they might be functions you think might be of great help to people of my generation?

I mean I don't…. but If I drove and certainly the technology that tells you the route, you set it up it comes up, that would be helpful really but now that I drive just locally. I know that this has been around a long time and when I go for instance with my son-in-law, even me I can understand that you know and its very … you know but I don't do that sort of motoring I would certainly want to use it if I did definitely.

So do you have any general comments?

Well its no very I sort of got mixed up with technology….I've tried to try to answer what you have asked me the best I can.

The only thing I'd find is whether its any better now, when you get a gadget, sometimes the instructions with it are illuminal they are written in 15 different languages but the English is not. I don't think Maybe they have got better now I don't know but perhaps it needs updating you know... one time you would read them and you thought that's not very helpful at all you know, that requires updating or something but maybe its better than now I don't know. That was my experience when I bought one or two bit of stuff but .. how to set up a clock or how to set it up the instructions were very poor and I don't think but its partly that they weren't written as they should have been you know. I don't know whether you have found this?

Its so important to get it right especially if you want to sell your product, you got to sell it isn't it?

What are your chances of accepting this device if I bring it to you?

Well I don't really want to use it, if it's..... I don't want to replace anything that I'm doing at the moment. I mean is that alright? That's what I honestly feel, I'm trying to give the honest truth that's what I feel.

But do you know that this product is available on the market?

Yes, I do well and even if I.... well to be honest if I start to get even more crappy my daughters would start to tell me ... they are very good they just tell me that I'm talking rubbish ... they are both uum very luck to have a couple of smashing girls.

So are they available to provide you with additional support?

Well in fact I've got a daughter who lives, well she and her husband got me to this place, was my wife alive when you worked here? She passed away 20018 so that so we moved her ......

I was three years at the university and three years in the army then I joined the gas industry uuum I had a language degree. I had to do six years night school to get a charted engineering then I was in the ......

APPENDIX: 16

Online survey

Online survey for caregivers

Start of Block: Participant Information Sheet

PIS **Participant Information Sheet**
Research participation Invitation You are invited to take part in research taking place at the University of the West of England, Bristol. This research is being conducted as part of the Professional Doctorate in Health Psychology degree. Before you decide whether you would like to join the project or not, we would like you to understand why the research is being done and what it will involve. *Research title:* Accessibility and acceptability of memory aid assistive technologies to enhance quality of life for older adults living with cognitive impairment or dementia living in the community. ***Why have I been invited to take part?*** The reason you've been invited is you might be supporting someone living with dementia or who has problems in remembering things. We are interested in gaining information about your views about the memory aid assistive technologies available to support people with dementia and memory problems to manage their daily routines without much need to rely on others.
Researcher: **My name is** Tracey Muponda and I am based in the Faculty of Health and Applied Sciences at the University of the West of England, Bristol. My email: Tracey2.Muponda@live.uwe.ac.uk.
Research supervisors (Director of Studies): **Dr Tim Moss**, email: Tim.Moss@uwe.ac.uk and **Prof. Richard Cheston**, email: Richard.Cheston@uwe.ac.uk. Both based in the Faculty of Health and Applied Sciences at the University of the West of England.
What is the purpose of the research? This research seeks to understand your thoughts about the memory aid technologies available to help older adults with dementia or memory problems. Currently, there are a lot of different types of technologies available such as electronic diaries, medication reminders, and audio recorded instructions which can help people with memory problems to get by their daily routines without needing much support from others. However, not everyone who could potentially benefit from it is doing so. We want to understand what is restricting people from using the technologies that can help them to live as independently as possible. We are also trying to understand if there are any barriers that prevent people from making use of these technologies and how best we can help people to use these devices. To help us answer these questions, we would like to hear from people who are providing support to someone who is experiencing problems with their memory, or who may have, for instance, a diagnosis of Mild Cognitive Impairment or dementia. ***Do I have to take part?*** It is entirely up to you to decide whether or not you want to be involved. If you do decide to take part, you are able to withdraw from the research without giving a reason until four weeks from the date you signed your consent form. If you want to withdraw from the study within this period, please write to: Tracey2.Muponda@live.uwe.ac.uk. Deciding not to take part or to withdrawal from the study does not have any penalty. ***Can I change my mind?*** Yes, if you decide to take part then you will still be free to withdraw at any time, and without giving a reason. A decision to withdraw from the study at any time will not affect the care or treatment you receive either now or in the future. Your participation in the research is fully voluntary. ***What will happen to me if I take part and what do I have to do?*** If you agree to take part, you will be asked to indicate your agreement on a consent form before taking part in the

online survey. You will not be required to disclose any personal information that will make you identifiable. ***What are the benefits of taking part?*** There are no direct benefits to taking part in this study. However, many people enjoy or value being given an opportunity to take part in research that could benefit others in the future. We are carrying out this study to understand more about how we can help people with dementia and memory problems live more independently. If you take part you will be contributing in gaining understanding based on your experiences of dealing with someone with memory problems or dementia on assistive technologies which might be used for future technology developments and how to make technologies more acceptable and accessible to those who could benefit from them. ***What are the possible risks of taking part?*** We do not foresee or anticipate any significant risk to you in taking part in this study. The study does involve talking about what can be uncomfortable things. If, however, you feel uncomfortable you can stop and withdraw from participating at any time. ***What will happen to your information?*** All research information will be stored in a locked, password protected and secure setting to which only the researcher and the research supervisors will have access in accordance with UWE requirements and also the Data Protection Act 2018 requirements. You can find more information about how we will use, store and process your data in the data privacy notice. All the information we receive from you will be treated in the strictest confidence. Please read our privacy policy here. ***Where will the results of the research study be published?*** A report will be written containing the research findings and will not contain any of your personal details that will be linked to you. This report will be available on the University of the West of England's open-access research repository. The report will also be submitted for publication in peer-reviewed academic journals. A hard copy of the report will be made available to all research participants if you would like to see it. Key findings will also be shared both within and outside the University of the West of England at various conferences. ***Who has ethically approved this research?*** The project has been reviewed and approved by the Faculty of Health and Applied Sciences Research Ethics Committee. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England at Researchethics@uwe.ac.uk. ***What if something goes wrong?*** If you have a concern about any aspect of this study, in the first instance you should speak to the researchers involved who will do their best to deal with your concerns. The contact details are found at the bottom of this information sheet. You can also contact my supervisors: Dr Tim Moss (Tim.Moss@uwe.ac.uk) and Prof. Richard Cheston (Richard.cheston@uwe.ac.uk).
What if I have more questions or do not understand something? If you would like any further information about the research please contact me in the first instance. My email address is: Tracey2.Muponda@live.uwe.ac.uk.

To save a copy of this Participant Information Sheet please click here.

End of Block: Participant Information Sheet

Start of Block: Consent form

CONS **Consent Form**
Please ensure that you have read and understood the information contained in the Participant Information Sheet which has been provided before this consent form. If you have any questions please contact a member of the research team:

Researcher : Tracey Muponda, email: Tracey2.Muponda@live.uwe.ac.uk
Research supervisors (Director of Studies): Dr Tim Moss, email: Tim.Moss@uwe.ac.uk; and Prof. Richard Cheston, email: Richard.Cheston@uwe.ac.uk. If you are happy to participate in this research please indicate below that you agree to the following: I have read and understood the information in the Participant Information Sheet which is provided before asked to sign this form I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.

○ I wish to take part in this survey

○ I do not wish to take part in this survey

End of Block: Consent form

Start of Block: Screening questions

SCR Do you provide some form of support for someone over 65 years of age with dementia or memory problems?

○ Yes

○ No

End of Block: Screening questions

Start of Block: Block 2

*

Q1 What is your age?

____

Q2 What is your gender?

○ Male

○ Female

○ Non-binary / third gender

○ Prefer not to say

Q3 What is your ethnicity

○ White

○ Mixed or Multiple ethnic groups

○ Asian or Asian British

○ Black, African, Caribbean or Black British

○ Other ethnic group

Q4 At what point did you leave formal education?

- ☐ No formal education
- ☐ Compulsory schooling level
- ☐ College/technical/trade school training level
- ☐ Some undergraduate degree level
- ☐ Some postgraduate degree level

Q5 What is your combined monthly household income?

- ○ Less than £1500
- ○ Over £1500 but less than £3000
- ○ Over £3000 but less than £5000
- ○ Over £5000
- ○ Don't know what to say
- ○ Prefer not to say

Q70 Where did you find out about taking part in this survey?

- ○ Join Dementia Research (JDR)
- ○ Some social media platform (Facebook, Twitter, LinkedIn)
- ○ Prefer not to say
- ○ Other, please specify ____

End of Block: Block 2

Start of Block: Background information for the supported person

Q6 Please provide information about the person you support.

Q7 What is the gender of the person you support?

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

*

Q8 What is the age of person you support?

____

Q9 What type of diagnosis do they have?

- ○ Mild Cognitive Impairment
- ○ Alzheimer's disease
- ○ Vascular Dementia
- ○ Other type of dementia
- ○ Undiagnosed but has problems with memory

Q10 At what point did they leave formal education?

- ○ No formal education
- ○ Compulsory schooling level
- ○ College/technical/trade school training level
- ○ Some undergraduate degree level
- ○ Some postgraduate degree level

Q11 Does the person you support have any of type of technological device such as a computer, smart phone, tablet, electronic calendar they currently use or have access to?

- ○ Yes
- ○ No

Q12 Can the person you support easily access any type of technological device?

○ Definitely can

○ Probably can

○ Might or might not

○ Probably cannot

○ Definitely cannot

End of Block: Background information for the supported person

---

Start of Block: CDRS

Q13
Please indicate what most closely applies to the person you support. These are general questions, so no one description may be exactly right.
Please indicate the answer that seems to apply most of the time on each presented title.

Q14 Memory

○ No memory loss or slight inconsistent forgetfulness

○ Consistent slight forgetfulness; partial recollection of events; “benign” forgetfulness

○ Moderate memory loss; more marked for recent events; defect interferes with everyday activities

○ Severe memory loss; only highly learned material retained; new material rapidly lost

○ Severe memory loss; only fragments remain

Q15 Orientation

○ Fully oriented

○ Fully oriented except for slight difficulty with time relationships

○ Moderate difficulty with time relationships; oriented to place of examination; may have geographic disorientation elsewhere

○ Severe difficulty with time relationships; usually disoriented to time, often to place

○ Oriented to person only

Q16 Judgment and problem solving

○ Solves everyday problems and handles business and financial affairs well; judgement good in relation to past performances

○ Slight impairment in solving problems, similarities and differences

○ Moderate difficulty in handling problems, similarities and differences; social judgement usually maintained

○ Severely impaired in handling problems, similarities and differences; social judgement usually impaired

○ Unable to make judgements or solve problems

Q17 Community affairs

○ Independently perform at usual level in job, shopping, volunteer and social groups

○ Slight impairment in these activities

○ Unable to perform independently at these activities although may still be engaged in some; appears normal to casual inspection

○ Appears well enough to be taken to activities outside the family home

○ Appears too ill to be taken to activities outside the family home

Q18 Home and hobbies

○ Life at home, hobbies and intellectual interests well maintained

○ Life at home, hobbies and intellectual interest slightly impaired

○ Mild but definite impairment of operating at home more difficult tasks abandoned; more complicated hobbies and interests abandoned

○ Only simple tasks preserved; very restricted interests, poorly maintained

○ No significant activities at home

Q19 Personal care

○ Fully capable of self-care

○ Needs prompting

○ Requires assistance in dressing, hygiene, keeping of personal effects

○ Requires much help with personal care; frequent incontinence

End of Block: CDRS

Start of Block: Background Information

Q20 What is your relationship with the person you support?

- ○ Spouse / Partner
- ○ Brother / Sister
- ○ Parent
- ○ Friend
- ○ Other family
- ○ Other

Q21 Before assisting the person you support, did you have any experience in assisting someone to remember things?

- ○ Yes
- ○ No

Q22 How much contact do you have with the person you support?

- ○ Less than 1 day per week
- ○ 1 day/week 2 days/week
- ○ 3-4 days/week
- ○ 5 or more days per week

Q23 How long have you been supporting them?

○ 0 to 6months

○ 6- 12months

○ 1-2years

○ 2-3years

○ Over 4years

Q24 What sort of support do you provide? *Please select all that applies*

☐ Booking and arranging to attend medical appointments

☐ Remind/prompt to take medication

☐ Remind/prompt to perform personal care

☐ Ensuring their safety by reminding them to check if cooker is switched off

☐ Remind to eat food and drink fluids

☐ Remind/prompt to do exercises

☐ Other, please specify ____

Page Break

Q25 I know where to get information and advice to obtain access to memory aid technologies such as tablets, smart phones and electronic calendars that the person I'm supporting could use to get by their daily routine?

○ Extremely knowledgeable

○ Very knowledgeable

○ Moderately knowledgeable

○ Slightly knowledgeable

○ Not knowledgeable at all

Q26 I have knowledge of the different types of memory aid technologies available which people with memory problems or dementia could use.

○ Strongly agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Strongly disagree

Page Break

Q27 What level of experience have you got in dealing with technological devices such as computers, smart phones, touchscreen tablets or digital calendar?

- ○ High experience
- ○ Moderate experience
- ○ Experience
- ○ Little experience
- ○ No experience at all

Q28 Before the person you support was diagnosed with dementia or had memory problems, what level of experience did they have in dealing with technological devices such as touchscreen tablets, smartphones or electronic calendars?

- ○ High experience
- ○ Moderate experience
- ○ Experience
- ○ Little experience
- ○ No experience at all

Page Break

End of Block: Background Information

Start of Block: TAM questions

TAM **Examples of Digital Calendar**

The images above are for a touchscreen memory prompting alarm calendar clock (digital calendar) that can be used for reminding or prompting. It contains numerous features that can be personalised according to user needs and can play memory-prompting messages and reminders which is designed to help with daily routines. It can be used to display clock, set alarms to go off at certain time intervals i.e. daily, monthly, weekly, yearly. The reminders can be personalised and can be in the form of audio, video and image reminders. Key features include: Timed playback of personalised video Timed playback of personalised photos with text Timed playback of slideshows Simplified touch screen alarm time memory prompt set up Send personalised greetings Plan a daily routine with video instruction Manage medication reminders, including short-term daily courses, e.g. antibiotics Easy music player – upload a favourite playlist of music, then play/pause/resume/shuffle/stop Create carer instruction video for one-touch playback Hearing impaired visual alarm notification Source: https://www.independentliving.co.uk/product/easylink-memrabel/ The next set of questions requires you to answer bearing in mind how using this type of memory aid device is likely to be viewed by the person you support.

Page Break

PU Q29 Please answer the following questions by choosing the answer that you think closely applies to the person you support.

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Using this type of memory aid device would increase the person I support's ability to manage their daily task.	○	○	○	○	○
The person I support would find this type of memory aid device useful in his/her daily activities.	○	○	○	○	○
Using this type of memory aid device would make it easier for the person I support to keep on track with some daily activities.	○	○	○	○	○
Using this type of memory aid device would improve the person I support's quality of life.	○	○	○	○	○

PEOU Q30 .

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think the person I support would find it easy to follow this type of memory aid device to manage her/his daily activities.	○	○	○	○	○
I think the person I support would find it easy to follow this type of memory aid device to achieve specific tasks on their own.	○	○	○	○	○
I think the person I support would find this type of memory aid device clear and understandable to use.	○	○	○	○	○
I think the person I support would find it easy to become skilful at using this type of memory aid device as a guide to get it to do what she/he wants it to do	○	○	○	○	○

ATT Q31 .

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think it is a good idea for the person I support to use this type of memory aid device to enable more independence.	○	○	○	○	○
I think it would be beneficial for the person I support to use this type of memory aid device.	○	○	○	○	○
I think using this type of memory aid device would be a positive influence for the person I support.	○	○	○	○	○
I think this type of memory aid device would be valuable for the person I support.	○	○	○	○	○

IOU Q32 .

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think the person I support would love to use this type of memory aid device.	○	○	○	○	○
I intend to encourage the person I support to use this type of memory aid device.	○	○	○	○	○
I intend to support the person I support to use this type of memory aid device.	○	○	○	○	○
I have intentions of learning to use this type of memory aid device in order to assist the person I support.	○	○	○	○	○

End of Block: TAM questions

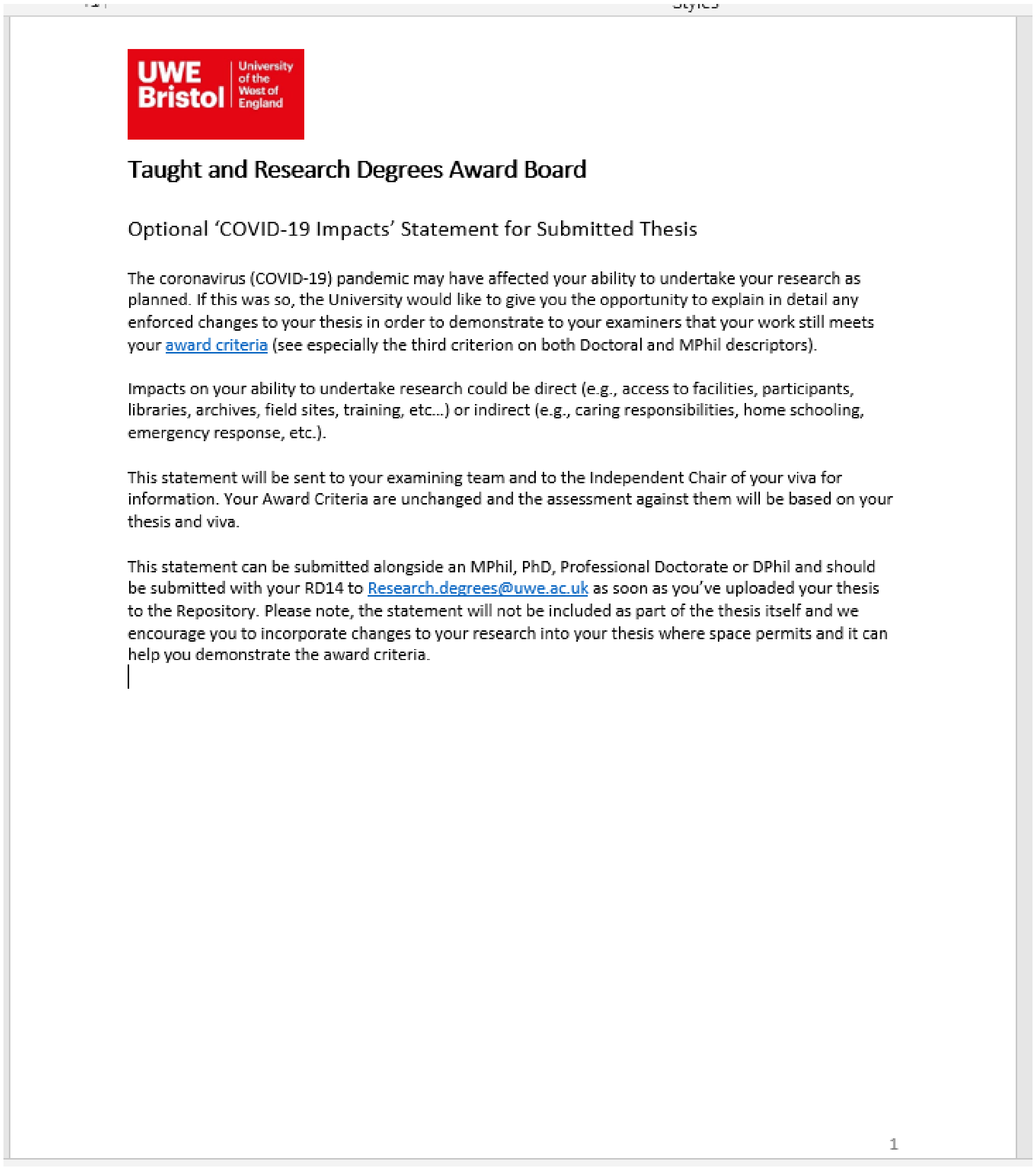
Start of Block: SCQ

SCQ Q33 Please answer the following questions providing answers that closely reflect how you feel at times when dealing with the person you support.

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I feel that my present situation with the person I support doesn't allow me as much privacy as I'd like.	○	○	○	○	○
I feel stressed between trying to assist the person I support and other family responsibilities, job etc.	○	○	○	○	○
I wish that the person I support and I had a better relationship.	○	○	○	○	○
I feel strained in my interactions with the person I support.	○	○	○	○	○
I feel that the person I support behaves the way they do to have their own way.	○	○	○	○	○
I feel that the person I support behaves the way they do to annoy me.	○	○	○	○	○
I feel that the person I support tries to manipulate me.	○	○	○	○	○

End of Block: SCQ

APPENDIX 17: Covid-19 Impact Statement



UWE Bristol University of the West of England

Taught and Research Degrees Award Board

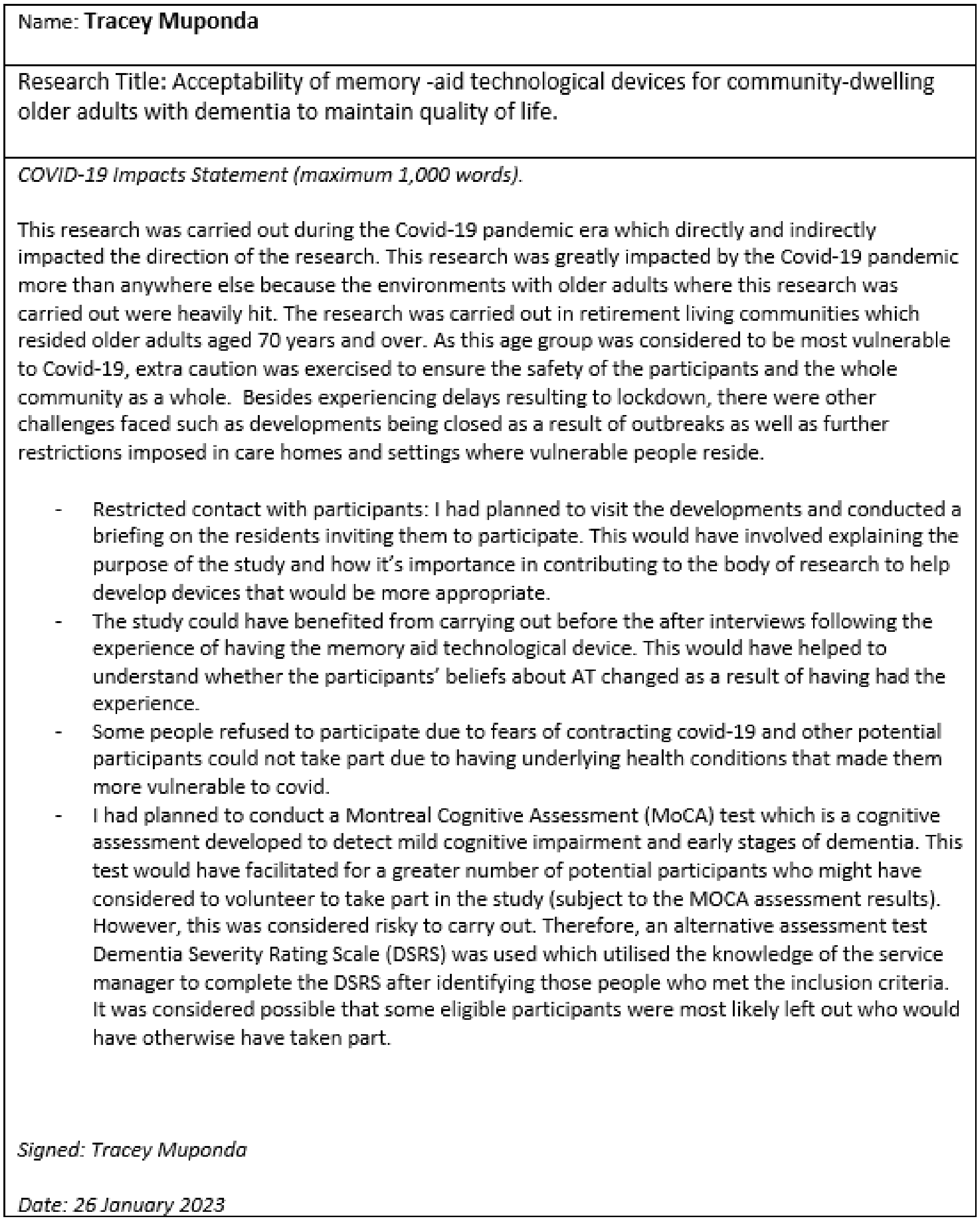
Optional 'COVID-19 Impacts' Statement for Submitted Thesis

The coronavirus (COVID-19) pandemic may have affected your ability to undertake your research as planned. If this was so, the University would like to give you the opportunity to explain in detail any enforced changes to your thesis in order to demonstrate to your examiners that your work still meets your award criteria (see especially the third criterion on both Doctoral and MPhil descriptors).

Impacts on your ability to undertake research could be direct (e.g., access to facilities, participants, libraries, archives, field sites, training, etc…) or indirect (e.g., caring responsibilities, home schooling, emergency response, etc.).

This statement will be sent to your examining team and to the Independent Chair of your viva for information. Your Award Criteria are unchanged and the assessment against them will be based on your thesis and viva.

This statement can be submitted alongside an MPhil, PhD, Professional Doctorate or DPhil and should be submitted with your RD14 to Research.degrees@uwe.ac.uk as soon as you've uploaded your thesis to the Repository. Please note, the statement will not be included as part of the thesis itself and we encourage you to incorporate changes to your research into your thesis where space permits and it can help you demonstrate the award criteria.



Name: **Tracey Muponda**

Research Title: Acceptability of memory -aid technological devices for community-dwelling older adults with dementia to maintain quality of life.

COVID-19 Impacts Statement (maximum 1,000 words).

This research was carried out during the Covid-19 pandemic era which directly and indirectly impacted the direction of the research. This research was greatly impacted by the Covid-19 pandemic more than anywhere else because the environments with older adults where this research was carried out were heavily hit. The research was carried out in retirement living communities which resided older adults aged 70 years and over. As this age group was considered to be most vulnerable to Covid-19, extra caution was exercised to ensure the safety of the participants and the whole community as a whole. Besides experiencing delays resulting to lockdown, there were other challenges faced such as developments being closed as a result of outbreaks as well as further restrictions imposed in care homes and settings where vulnerable people reside.

- Restricted contact with participants: I had planned to visit the developments and conducted a briefing on the residents inviting them to participate. This would have involved explaining the purpose of the study and how it's importance in contributing to the body of research to help develop devices that would be more appropriate.
- The study could have benefited from carrying out before the after interviews following the experience of having the memory aid technological device. This would have helped to understand whether the participants' beliefs about AT changed as a result of having had the experience.
- Some people refused to participate due to fears of contracting covid-19 and other potential participants could not take part due to having underlying health conditions that made them more vulnerable to covid.
- I had planned to conduct a Montreal Cognitive Assessment (MoCA) test which is a cognitive assessment developed to detect mild cognitive impairment and early stages of dementia. This test would have facilitated for a greater number of potential participants who might have considered to volunteer to take part in the study (subject to the MOCA assessment results). However, this was considered risky to carry out. Therefore, an alternative assessment test Dementia Severity Rating Scale (DSRS) was used which utilised the knowledge of the service manager to complete the DSRS after identifying those people who met the inclusion criteria. It was considered possible that some eligible participants were most likely left out who would have otherwise have taken part.

Signed: Tracey Muponda

Date: 26 January 2023

APPENDIX 18

Table 1.5.1 Chi-Squared Tests

	Value	df	p
X^2	15.975	3	0.001
N	119		

Table 1.6.1

Chi-Squared Tests

	Value	df	p
X^2	1.065	2	0.587
N	119		

Table 1.7.1

Chi-Squared Tests

	Value	df	p
X^2	19.230	3	< .001
N	119		

Table 1.8.1

Chi-Squared Tests

	Value	df	p
X^2	4.546	4	0.337
N	119		

Table 1.9.1

Chi-Squared Tests

	Value	df	p
X^2	0.141	1	0.707
N	119		

Table 1.10.1 Chi-Squared Tests

	Value	df	p
X^2	2.039	3	0.564
N	119		

Table 1.11.1 Chi-Squared Tests

	Value	df	p
X^2	16.257	4	0.003
N	119		

Table 1.12.1

Chi-Squared Tests

	Value	df	p
X^2	2.553	2	0.279
N	119		

Table 1.13.1

Chi-Squared Tests

	Value	df	p
X^2	3.067	3	0.381
N	119		

Table 1.15.1

Chi-Squared Tests

	Value	df	p
X^2	9.205	1	0.002
N	119		