The experiences of people with dementia and their carer’s with Assistive Technology.

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I declare that this submission is my own work. Where I have read, consulted, and used the work of others I have acknowledged this in the text.

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# Abstract

The use of Assistive Technology within dementia care by people with dementia and their carers has been seen as a predominantly positive experience, however, this use does not come without its barriers. Willingness, awareness, and funding have previously been linked to the barriers and lack of use of Assistive Technology. This Rapid Structured Literature Review examined the experiences of people with dementia and their care givers with using Assistive Technology. Studies were found using two databases (Taylor and Francis and EBSCO). These studies were then analysed using thematic analysis. Six studies met the inclusion criteria. The findings showed that the main barrier associated with the lack of use of Assistive Technology is lack of awareness to Assistive Technologies. It was also found that some individuals with dementia have feelings of embarrassment when using certain Assistive Technologies. However, positives have been highlighted throughout. It was seen that the perceived usefulness of Assistive technology is known to a great extent, also, some Assistive Technologies can be used as diagnostic tools as well as aids. Overall, Assistive Technology is seen as useful, providing care givers with an aid unmatched.

# Introduction

Assistive technology (and its use by people with dementia and their carers) has aided the everyday lives of many people. The use of Assistive Technology can assist with anything from planning, to eating with more ease, to alerting a carer to an emergency (Sriram, 2020). Whilst Assistive Technologies are very promising and are an amazing aid to many, they often come with an accompaniment of limitation. Whilst some limitations may be self-inflicted with regards to willingness to use dementia specific Assistive Technologies or technology in a more traditional sense of the word (Cooper, 2021). Others may occur due lack of eligibility, financial reasons or due to the Assistive Technology being designed without the user in mind or for a completely different user group (Vollmer, 2020). As can be seen in Sriram (2020), some people with dementia and their carers use smart home speakers as Assistive Technologies, things like Google Home or Alexa. The issue with these technologies is that dementia patients and their carer’s are not the target user group.

 This topic is important to investigate for a number of reasons, firstly; for user experience designers, and researchers of technologies and Assistive Technologies, to be aware of what users enjoy, and similarly, what they do not enjoy about different equipment. Likewise, if a technology like Google Home or Alexa were to become more inclusive it would be a positive leap in the direction of acceptance and awareness of neurodegeneration and Assistive Technology. Secondly, it is important for carers, both professional and informal to be made aware of technologies and their availabilities (Puaschitz, 2021). The awareness (or lack thereof) of availability of Assistive Technology is a hinderance with regard to development of the area. Some people with dementia and their carer’s, resort to using everyday items for purposes beyond their recommended use (Gibson et al., 2019). Lastly, this topic is important for practising psychologists to become more familiar with and learn more about Assistive Technology, its uses, functions, and abilities. This may improve their understanding of the everyday lives of some of their clients.

*“In examining disease, we gain wisdom about anatomy and physiology and biology. In examining the person with disease, we gain wisdom about life”* –Sacks (1973).

Perfectly explained, Sacks (1973) believed that by studying the person with the disease, we can gain more information about their life. In this case, people with dementia and how they live with their disease with the aid and assistance of Assistive Technologies. By looking qualitatively at how an individual and/or their carer whether formal or informal are living firstly without any or little form of aid. Then with aids, and what works for them and more importantly what does not work for them. We can see how to help these people. What they need help with and how to develop technology to help. This Rapid Structured Literature Review is an attempt at gaining more wisdom about the lives and limitations of carers of and people with dementia with regard to Assistive Technology.

Assistive Technology is an important aspect of Human-computer interaction as it allows users to improve their lives by using (often) very simple Technologies.

“*Assistive technology (AT) refers to electronic or mechanical devices that can support independence and improve quality of life by assisting with daily living activities, reducing harmful risks and improving communication”* (Howard et al., 2021 – p. 883).

While often associated with improving the quality of life of people with disabilities, its importance in the lives of carers must not be over-looked. Yousaf et al. (2020) spoke about the potential benefits of mobile based apps for healthcare in general, they note that pain assessment apps make care givers lives much easier. Similar benefits have been noted for video monitoring and navigation style apps. Yousef et al. (2020) mentioned that there has been major growth in general mobile health (mHealth) apps but unfortunately the same could not be said about dementia specific mHealth apps. The reasoning for the lack of development and growth of Assistive Technology for dementia care is what will be explored throughout. This will be explored by reviewing present day literature focusing on the use of Assistive Technology in dementia care settings. Establishing how carers interact with technology while caring for people with dementia in an attempt to better understand what works and what does not work from user experience and behavioural perspectives.

Dementia has been defined by The Alzheimer Society of Ireland (2022) as “the name for a range of conditions that cause damage to the brain. This damage can affect memory, thinking, language and the ability to carry out everyday tasks. There are many conditions which cause dementia. Alzheimer’s is the most common cause. Vascular dementia, dementia with Lewy bodies and Frontotemporal dementia are other causes.” There is a strong prevalence of dementia within Ireland, The Dementia in Europe Yearbook 2019 noted that by 2025 there will be 65, 000 people with dementia in Ireland, this number is expected to reach over 141, 000 by the year 2050.

Previous literature has consistently noted that the Assistive Technology world is on the rise for general health needs. Whether these Assistive Technologies are mHealth apps for disabilities or lifestyle tracking apps, it is still a significant improvement for the health and wellbeing of the public. However, the technologies for dementia care specifically are unfortunately far behind what they should be. For example, Fitbit is such a widely used technology device that assists the user with tracking their motion. It can be used by anyone and is marketed towards everyone. Baalbaki et al. (2017) describes it as an addiction. The excessive use of lifestyle and health Assistive Technology is apparent and its’ resulting effect even more so (Cavero-Redondo et al., 2020). As will be explained throughout this review, having only come across six studies when looking at dementia care and Assistive Technologies is one concern, similarly, the awareness is another. The technology is there in its most basic form. It seems that people with dementia and their carer’s are unaware of this. Accordingly, developers of the technology are unable to develop their technology further. It seems to follow a supply and demand type rule however there is plenty of supply with no real demand.

The lack of development is associated with the lack of use, similar to the quote above by Sacks (1973) by examining we gain wisdom, only, if there is minimal to no use, examining cannot take place. Questions that can be answered with the help of a Rapid Structured Literature Review may be: (1) association with the lack of use, (2) areas like culture, (3) phenomena, such as ingression, or (4) technological areas, such as machine learning. Ingression refers to a phenomenon with which an individual resorts to a previous state of being, to a younger time of their lives. The Swedish Council on Technology Assessment in Healthcare (2008) noted its similarities to regression but prefer to label it as ingression. Machine learning refers to the personalisation of technology, catering to the user (El Naqa et al., 2015). The literal learning of a user by a technology. A more everyday example of machine learning is predictive texting on a mobile phone, using past phrases and words to predict what a user will say.

 For the reasons outlined above, the inclusion of a Rapid Structured Literature Review focusing on the limitations of Assistive Technology on the quality of use and care of/to carers and people with dementia would be invaluable. With the population of people with dementia growing year on year in Ireland, the lack of awareness, funding and willingness to approach and utilise Assistive Technology. Then in turn develop it further in the field of dementia care, it is important to be aware of the factors related with this lack of use. Furthermore, the barriers associated with the lack of use must be explored with all parties (developers, users, practitioners, etc.) being thought of throughout the exploratory process.

# Aim

The aim of this Rapid Structured Literature Review is to determine: (1) The barriers associated with the lack of use of Assistive Technology within Dementia Care,( 2) What users of Assistive Technology find positive about their Assistive Technology, (3) What can be done to improve Assistive Technology in the future, and (4) What Assistive Technology is being used at present.

# Review Design and Methodology

A Rapid Structured Literature Review was utilised to explore potential limitations surrounding the use of and engagement with Assistive Technology by informal caregivers of people with dementia. Initially, whilst exploring this area, bricolage was noted in an article by Gibson et al. (2019) in referring to the idea, application, and. process where “we ‘bodge’ using whatever objects are at hand to achieve a solution, or we may use devices in different ways to their intended purpose, simply because these solutions work for us” (p. 12). In this circumstance there is the implication of using technology for a purpose other than that in which it was intended. The need for and apparent malleableness of everyday technologies sparked this Rapid Structured Literature Review.

A Rapid Structured Literature Review was necessary for this need as there is an abundance of literature surrounding the area of Assistive Technology use by caregivers of people with dementia but a supposed lack of why specifically the Assistive Technology is unavailable or simply unused by caregivers of people with dementia. A select few have looked at specific reasons behind the lack of use or limitations of Assistive Technology, such as O’Conner et al. (2021) and the area of eConsent with regard to mHealth and mobile applications. Also, the issues of cost and people with dementia simply not wanting to use Assistive Technology arose in a systematic review by Kruse et al. (2020). The issue of older adults being unwilling to use Assistive Technology or emerging technology in general is a major problem which Kadylak et al. (2020) acknowledged, explaining there is a major dependence on type of technology when determining want of use. They found that only 15% of participants would be willing to use virtual reality which is staggering as Garcia-Betances et al. (2015) found that virtual reality is not only promising but encouraged when used in dementia related therapy.For the reasoning outlined above it was necessary to determine inclusion and exclusion criteria:

## Inclusion:

1. Papers that named all caregiver/carers were included (as articles in this field mention either professional or informal carers or indeed do not distinguish between the two),
2. Papers that were published in or after 2007 were included (the decision to only include papers from 2007 and after was to ensure all appropriate research will be utilised. Also, the first paper in this area in Ireland that could be found was published in 2007 (Cahill et al., 2007), similarly, the Journal of Assistive technology was founded in 2007),
3. Results that mentioned either Virtual Reality and/or mHealth instead of Assistive Technology in the title were included (based on publications by namely O’Conner (2021), Kadylak (2020), Yousef (2020) and to a certain extent Garcia-Betances (2015) it was apparent that both Virtual Reality and mHealth were both in the forefront of assistive technology within dementia care),
4. Papers which noted strictly dementia in the title were included,
5. Papers which used participants over the age of 65 were included. As dementia is mainly an age-related illness, it was important for this study to use papers which engaged with the certain age demographic affected.

## Exclusion:

1. Results published pre-2007 were excluded;
2. Reviews were excluded;
3. Pilot studies were excluded;
4. Results that did not specify either Assistive Technology or Dementia care were excluded.

***Figure 1***

***Flow chart of study selection process.***

|  |
| --- |
| Titles identified and screened |
| n = 32 |

|  |
| --- |
| Excluded |
| n = 12 |

|  |
| --- |
| Abstracts Screened |
| n = 20 |

|  |
| --- |
| Excluded |
| n = 14 |

|  |
| --- |
| Studies that met the inclusion criteria |
| n = 6 |

Studies were identified by using two peer -reviewed academic databases, Taylor and Francis and EBSCOhost. It was decided to search as far back as 2007 for a number of reasons, Cahill et al. (2007) was the first (known) paper in the area of Assistive Technology use in Dementia care in Ireland. Another reason for this date is that The Journal of Assistive Technology was founded in 2007. After the initial search, thirty-two papers were found. This was reduced to twenty after screening titles. Abstracts were then screened reducing the number of papers to six.

# Results

Six studies were included in the review. The publication date for the studies ranged from 2007 to 2020. Each study’s participants consisted of people with dementia and their caregivers (when possible). Some people with dementia were not accompanied by their caregiver. Caregivers included may have been family members in some cases. It is evident that strong relationships have been developed between caregivers and people with dementia. Within the study by Cahill et al. (2007) in particular, the people with dementia included their caregiver in their answers, This included the person with dementia who was relieved that she did not feel like she was “running to Deirdre (caregiver)”, and the Assistive Technology that “gives her a sense independence” (p. 137). The awareness of people with dementia for the potential and benefit that can be gained with Assistive Technology is interesting and promising as can be seen throughout each study. A breakdown of each study can be found in Table 1. An examination of the research papers and articles was undertaken under the themes:

- Barriers to the use of Assistive Technology.

- Positive opinions of the Technology examined.

- Potential ideas to improve design and usability of the technology.

- What technology is used at present.

 Of the six studies, two were from the United Kingdom, one was from Ireland, and the final three were from Canada, Sweden, and Singapore respectively. There is a significantly larger sample size in the study by Davis et al. (2020; n = 495) though the reason for this is perhaps that this study is a sub-study of a larger one named the ATILLA Study (Assistive Technologies and Telecare to Maintain Independent Living at Home). One other point worth noting is that some findings from the studies used within this current study may be slightly biased as they are promoting their own product (e.g., Lai Kwan et al., 2019).

***Table 1***

***Breakdown of Papers included.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Author | Title  | Location | Sample | Type of Technology | Year |
| van den Heuvel et al. (2012) | Awareness, requirements, and barriers to use of Assistive Technology designed to enable independence of people suffering from Dementia (ATD). | UK | PwD n = 58Carers n = 25Total sample  N = 83 | -Wheelchair.-Hearing aid.-Walking stick.-Glasses. | 2012 |
| Cahill et al. (2007) | "It gives me a sense of independence" – Findings from Ireland on the use and usefulness of assistive technology for people with dementia. | Ireland | PwD N = 34Caregivers were included in investigation.  | -Calendar.-Picture Button Telephone.-Automatic Night Lamp.-Item Locator.-Gas Cooker Monitor. | 2007 |
| Davies et al. (2020) | The impact of assistive technology on burden and psychologicalwell-being in informal caregivers of people with dementia(ATTILA Study) | UK | PwD N = 495Caregivers were included where available.  | -Non-monitored smoke/carbon monoxide alarm.-Key Safe-Pendant Alarm. | 2020 |
| Lai Kwan et al. (2019) | Wearable Technology for Detecting Significant Moments in Individuals with Dementia. | Canada | PwD n = 3Caregivers n = 33 Dyads (Person with Dementia and their care giver)Total sampleN = 6 | -Triple Point Sensor.-Events Finder.  | 2019 |
| Malmgren Fänge et al. (2020) | Using sensor‐based technology for safety and independence – the experiences of people with dementia and their families. | Sweden | PwD n = 9Family Members n = 21Total sample N = 30 | -Door and window Alarm.-Moisture and Flood Alarm.-Fire Alarm.-Temperature Alarm.-Bed Alarm.-Night Lamp.-Bathroom Sensor.-Fridge Sensor. | 2020 |
| Aloulou et al. (2013) | Deployment of assistive living technology in a nursing home environment: methods and lessons learned. | Singapore | Pwd n = 8Caregivers n = 2Total sample N = 10 | -Motion Sensor.-Pressure Sensor.-Proximity Sensor. -Vibrator.-Smart-phone.-Nursing Console.-Speakers. | 2013 |

***Table 2***

***Aims, methods and findings of papers included.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Author | Aim | Method | Findings | Year |
| van den Heuvel et al. (2012) | To investigate the awareness and use of assistive technology for people with dementia | Focus Groups | * Need for new technology development.
* Lack of Awareness is the most important barrier to Technology adaptation.
 | 2012 |
| Cahill et al. (2007) | * Whether new prototypes can be used.
* Whether any Technical difficulties were experienced.
* Whether these technologies could be better refined.
* Whether these technologies are financially viable.
 | Exploratory descriptive design |  Most devices trialled were considered useful. | 2007 |
| Davies et al. (2020) | To assess the impact of ATT on informal caregivers’ burden and psychological well-being. | Randomised-controlled trial |  No significant between- or within-group differences at any point on caregivers’ burden, anxiety, and depression levels were found. | 2020 |
| Lai Kwan et al. (2019) | To determine whether wearable technology can detect significant moments individuals with dementia. | Evaluation of Assistive technology. | Algorithms could detect moments of significance experienced by either member of the dyad. | 2019 |
| Malmgren Fänge et al. (2020) | Experiences, needs and benefits with using sensor-based technology for safety and independence in the homes of people with dementia and their family members. | Semi-structured interviews. | * Technology is considered a safety measure that can provide a sense of control of the everyday life of the person with dementia.
* Understanding and acceptance of the technology are important.
 | 2020 |
| Aloulou et al. (2013) | To evaluate the performance and usability of assistive technology in a nursing home | Focus groups | Provides the ability to detect early degradation of patients.  | 2013 |

# Findings

## Barriers to the use of Assistive Technology

Many Themes (or indeed sub-themes) were established throughout the “Barriers to the use of Assistive Technology” Theme. Themes such as “lack of awareness” of Assistive Technology, a lack of experience was found to be a contributing factor to the barrier to the use of Assistive Technology. Another contributor identified were aspects of personal and emotional factors. The final sub-themes consisted of technical issues, privacy and consent, and the technology simply not fulfilling its purpose.

The main barrier consistent throughout Van den Heuvel et al. (2012) is a lack of awareness of Assistive Technology for people with dementia. As mentioned in Table 1, the type of technologies concerned with their study are more common, basic types of aids, including wheelchairs, hearing aids, walking sticks, and glasses. This shows the lack of awareness of the other types of Assistive Technologies that are available. Van den Heuvel et al. (2012) noted “93% (of participants) indicated they did not know of any potentially useful Assistive technology” for people with dementia. Another barrier seen within their paper was the lack of want to change Assistive Technology. One participant explained it as “Like torture to change them (hearing aids) sometimes”. Lack of experience and reluctance to engage with technologies were other barriers noted. Within the carer sample focus group (n = 12) and the survey (n = 42), none of the participants had any personal experience with Assistive Technology for people with dementia. Fear has been a consistent theme throughout each paper, though there are other emotionally based barriers to the use of Assistive Technology for people with dementia. For example, Cahill et al. (2007) noted stigma as a barrier of use for Item Locators. Item Locators are small tags which attach to everyday items such as keys, bags, wallets etc. This allows for items to be found if misplaced. A more common example of this technology would be the Apple AirTag. Cahill et al. (2007) continues to explain that one participant was embarrassed to use Item Locators as they reminded the participant of her illness. In this instance, the woman would try to hide the locators. There was also an emotional factor from the family/carer’s perspective. An example of this is in the study by Malmgren Fange et al. (2019), where some carers expressed a sense of safety when they had a sensor in their home. The feelings of either the people with dementia or their carer was very consistent throughout each paper. Though, some feelings or actions were influenced by their dementia, some people with dementia needed to be reminded to use certain products (Cahill et al., 2007). A carer in the study by Malmgren Fänge et al. (2020) noted they “did not wish to be responsible for the person’s everyday safety, instead, they wanted to maintain the role of relative” (p. 6). This issue arose when multiple people had an alarm connected to their phones for one person with dementia, not all family members were aware of their own role in caring for their relative; the family member explained, “I do not want to be a carer for my mother … the technology intrudes on our relation” (p. 6)

There will always be challenges when bringing out new technologies. It is an unavoidable part of development for this area. Within studies which recorded technical issues surrounding their technology, these technical issues evolved into barriers. If a technology would not work on a mechanical level, it would not work on a functional level. In addition to this, participants (namely carer) lost trust in specific technologies when those technologies developed technical issues. Documenting this, Cahill et al. (2007) noticed that the carers would stop using the technology altogether when faced with technical issues. An example from the study by Cahill et al. (2007) being a gas cooker monitor. Every participant trialling this technology dropped out of the trial due to technical issues.

Privacy may also be an issue when it comes to Assistive Technology and dementia care. This is for a number of reasons, for example, in order to use any application on a device (mobile phone, tablet, laptop) the user must give consent, which means, the user must fully comprehend the application in use. This is an issue as some people with dementia may not comprehend an application or may not be able to provide consent (or both). Another example of privacy as an issue is with video cameras/monitoring devices. When a monitoring device is equipped in a home setting for example, it may record people/family members without their consent. As a solution to consent within mobile applications, O’Connor et al. (2021) looked at implementing eConsent with mobile applications. However, Malmgren Fange et al. (2019) noted that family members expressed that they “needed to choose between privacy and safety” (p.7). This dilemma forces the people with dementia and their carers to weigh up which aspect is more beneficial: a very difficult decision to make. Though, it has been seen that some people with dementia and their carer’s are willing to choose technology (and in turn, safety) at the expense of privacy (Malmgren Fange et al., 2019).

Lastly, the important question of “does the Assistive Technology actually work?” must be asked. In some instances, it does not. As with technical difficulties, when technology did not work, carers/family members lost trust (Cahill et al., 2007). Technologies may fulfil their purpose, but only to a degree. For example, door sensors which do not distinguish between a person entering or exiting were seen as an issue (Malmgren Fange et al., 2019). Other than sensor technologies, the other Assistive Technology that did not fulfil its intended use was the night lamp. Though, participants expressed an interest in its potential usefulness, it may have been an opinion of the people with dementia to not use this specific device. For example, within the study by Malmgren Fange et al. (2019) one person with dementia experienced the phenomenon known as ingression, highlighted earlier in this paper; the person with dementia would plug out the night lamp because this is what they did when younger.

## Positive Opinions of the Technology

Negative opinions tended to outweigh positive opinions with regards to usefulness to a developer. This may be due to positive opinions being of little value to developers aiming to improve their technology. However, certain positive opinions were shared. Most participants commented on the usefulness of certain technology they used. A caregiver in the Cahill et al. (2007) study described their lost item locator as “handy, useful, brilliant, a lifesaver which is missed dearly when it’s not working” (p. 138). Usefulness was also a common theme throughout Malmgren Fänge et al. (2020), a study that was looking primarily at sensor-based Assistive Technology. Malmgren Fänge et al. found that certain sensors can help with the postponement of moving people with dementia into a nursing home. It allows caregivers to monitor people with dementia whilst also keeping up independence among the people with dementia themselves. Similarly, the use of sensor-based Assistive Technology has been utilised in a nursing home environment (Aloulou et al., 2013), this allowed for accurate tracking and monitoring of patients’ movements. An unintended positive side effect was noted by the caregivers of the study by Aloulou et al. (2013). They found that a patient who would normally require less than six reminders a day, suddenly began to receive up to twelve. Caregivers normally reminded this patient to turn off a tap or a light for example, no more than six times a day, then suddenly the amount of these reminders increased to twelve times a day. This notified the caregivers of a deterioration in this patients’ wellbeing, thus allowing for more care to be given. Within all other studies, participants showed enthusiasm regarding the potential benefits of Assistive Technology for people with dementia.

## Potential ideas to improve Design and Usability of Technology

 The overall consensus of each study is that all Assistive Technology used could be improved in some way. Some of these improvements may overlap with the removal of certain barriers such as: better usability, more emphasis on privacy of people with dementia or indeed engaging with people with dementia or their carers in the development process of these technologies. The ATILLA Study (Davis et al., 2020) lacked potential improvements as a theme throughout their study, they mentioned that with a smaller sample size and a more direct emphasis it may produce a stronger positive impact on carer well-being; though, this is only relevant for the ATILLA Study (Davis et al., 2020).

 Within van den Heuvel et al. (2012), participants mentioned the want and “clear need for” an entertainment system or aid to interaction, this is to help facilitate conversation among people with dementia. Van den Heuvel et al. (2012) noted that at the time of writing, this technology has been developed but was not yet available. It is understood that this conversation aid is still in development, and, having received funding as part of the Horizon 2020 Programme, the CIRCA Project (Astell et al., 2018) is promising for this area of Assistive Technology and Dementia care.

 The implementation of a more socially-orientated technology was mentioned by Lai Kwan et al. (2019) though from a less optimistic perspective. They wrote, “less than 2% (of Assistive Technologies) are intended to assist with the social and relational challenges associated with this condition(dementia)” (Lai Kwan et al., 2019; p. 10). There certainly appears to be scope to develop more aids in this area. An important note by Lai Kwan et al. (2019) is that the carers of people with dementia are attuned to the non-verbal behaviours of people with dementia and to implement this in some way in the development of Assistive Technology for dementia care is a must. However, from a more user interface and user experience perspective, Lai Kwan et al. (2019) mentioned that the implementation of a machine learning approach to certain Assistive Technology might be a positive step. Allowing the technology (in this case wearable devices) to become more personalised to the user (people with dementia) would be a definite improvement.

 User Interface and User Experience type themes continue within the studies by Cahill et al. (2007), Aloulou et al. (2013), and Malmgren Fänge et al. (2020). Participants in the study by Cahill et al. (2007) suggested potential improvements for each piece of Assistive Technology used. The inclusion of a clock and the year to be included in a “night and day calendar” would be of great benefit to both carer and person with dementia. Multiple participants wanted the text to be made clearer also. Participants gave ideas for font colour that may make it easier to read. In response to the individual who expressed dissatisfaction for the Item Locators, her caregiver suggested that the locator tags could be neater and more streamlined and also for them to be louder (p. 139). In a similar note, the participants wanted more accessible contacts on “The Picture Button Telephone”. The participants believed this change will make the Assistive Technology more usable and user friendly. These small adjustments and amendments given by participants were similarly mirrored in both Aloulou et al. (2013) and Malmgren Fange et al. (2020). For example, with the use of sensor-based Assistive Technology, Aloulou et al. (2013) noted that taps which would automatically turn off when not in use/left on too long would be helpful. They stated that this addition would be “easily integrated in our platform” (p. 12). When looking at the technology used by the carers in this study, an amendment to the logging in process was encouraged, in order to reduce the amount of “clicks” required. Informal carers expressed the want to know what their family member/Person with Dementia was doing, some form of monitoring device, for example. This does, however, contradict the desire for privacy mentioned earlier. A way around this might be to turn them on only when needed (Malmgren Fange et al., 2020).

Lastly, the implementation of Assistive Technology was an important finding. Participants in the Malmgren Fange et al. (2020) study believed the earlier the better for the implementation of Assistive Technology. This allows people with dementia and their carers to get used to the Assistive Technology. They noted, “It was important to introduce technology early in the dementia disease process when it was still possible for the person to understand the function of it” (p. 6). Before the deterioration or degeneration of an individual’s mental state due to dementia, the implementation of Assistive Technology should be done in a timely manner. The sooner a technology is implemented into dementia care, the easier it will be for the person with dementia to grow accustomed to it.

## What technology was used.

 Many different types of Assistive Technologies were examined throughout the six papers included in this Rapid Structured Literature Review. Within Table 1, it can be seen what technology was examined by each paper. Van Den Heuvel et al. (2012) were concerned with more basic types of Assistive Technology as this is what their participants had greater familiarity with. Things such as wheelchairs, hearing aids, walking sticks and glasses were explored from an independence perspective. Cahill et al. (2007) were more concerned with the usefulness of technologies such as: Calendars, Picture Button Telephones, Automatic Night Lamps, Item Locators and Gas Cooker Monitors. The papers which were published in later years included more advanced technologies, Lai Kwan et al. (2019) were interested in Triple point sensors and events finders, these were used to detect significant moments in individuals with dementia. It allowed carers to see how a person’s dementia is progressing or deteriorating. Malmgren Fange et al. (2020) examined technology to aid a person’s independence, this technology included: Door and window alarms, moisture and flood alarms, fire alarms, temperature alarms, bed, and night alarms, along with sensors for the bathroom and fridge. These technologies are conceptually simple and practically perfect Lastly, Aloulou et al. (2013) examined motion sensors, pressure sensors, proximity sensors, vibration devices and used a smartphone to view analytics for each sensor and device. Speakers and a nursing console were used to communicate with individuals in care.

# Discussion

The current study has highlighted the potential reasons why Assistive Technology has not yet reached its full potential. These reasons include such barriers as awareness, funding, willingness to use, or simply that the technology does not work. This finding raises some important questions.

The current review found that individuals understand, appreciate, and acknowledge the use and usability of Assistive Technology. Participants within studies included in this review exclaimed enthusiasm toward Assistive Technology as a whole. Carers’ awareness of available Assistive Technology varies; however, the majority of carers are aware of Assistive Technology on a basic level. There may, however, be a lack of want or willingness to engage with Assistive Technologies, this may stem from either the carer or the person with dementia.

There may be cultural reasons behind the barriers to Assistive Technology use within dementia care. Can culture or nationality play a role in the use (or lack thereof) of Assistive Technology within dementia care? Within the paper by Aloulou et al. (2013), it can be seen that the technology used by carers/people with dementia was far more advanced than van den Heuvel et al. (2012). This is worthy of noting as both studies are from within one year of each other yet one is from the United Kingdom and the other is from Singapore. Brown et al. (2019) investigated smartphone-based interventions for Alzheimer’s disease and found that there were in fact cultural differences in the use of this technology. It was also found that little development has been done on caregiving mobile applications for Alzheimer’s disease within Hispanic populations in comparison to other populations. As cultural differences can be seen within this current study, it may be useful to research more in the area of culture and Assistive Technology. In addition to this, it was noted by König et al. (2018) that the ageing population in Sweden had the second highest internet use in the world, this would assist with the observation that there has been a stronger advancement in technology use (and indeed openness to Assistive Technology use) within Sweden in comparison to other developed cultures.

 Each paper explored within this study was unique, some papers were similar, and all were looking at the same area (Assistive Technology and the factors associated with its lack of use within dementia care). However, each paper also had significant differences, including whether these differences were surrounding the Technology explored, the perspective from which the use of the technology was explored, or the findings from each. For example, within Aloulou et al. (2013) researchers installed sensors and monitoring technologies in a nursing home setting, this was trialled between March 2010 and December 2012. After gathering the information from the researcher’s technology Aloulou et al. (2013) interviewed participants within the nursing home to gather their observations of the technology. Alternatively, to this, Malgram Fange et al. (2019) studied sensor-based technology but from a home setting. They also used interviews to gather information from participants. Both studies found observed similar findings, the technology can “facilitate the life situation for people with dementia and their families” (Malgram Fange et al., 2019, p. 6). Similarly, Aloulou et al. (2013) mentioned the “staff would like to have the full system deployed in each room” (p. 14) this quote highlights the extent to which aid of Assistive Technology can provide staff of a care setting. From the context of the current study, this is an advantage as it can supply a broader understanding of the literature. This allowed for a more comprehensive idea of the barriers and factors associated to the lack of use of Assistive Technology within dementia care. It must be noted, whilst acknowledging the differences within the sample papers, the main finding from each paper was consistent. Awareness of different types of Assistive Technology or indeed Assistive Technology in general was limited. However, this issue appears to be resolving itself, as can be seen in Table 1 and Table 2, the findings and the technology used become more refined. The evolution of this area can be seen within these Tables. The technology used within older studies utilises more basic types of technology, with more advanced technologies being used in contemporary studies. This shows a greater understanding of the area and the technology. Users of Assistive Technology have an awareness of what works well for their needs – and in turn, what does not.

 The phenomenon of ingression was touched upon, as a known element of dementia, it is strange that it is only spoken of in one paper. Ingression is commonly observed in dementia. However, this phenomenon was only mentioned in one of the papers (Malmgren Fange et al., 2019). This has exhibited itself as a factor which is associated with the cause of the lack of use of Assistive Technology yet is not recognised as such within previous literature. Though, it was noted by The Swedish Council on Technology Assessment in Healthcare (2008) that the choice of the word “ingression” was used meaning the same as “regression”, yet they preferred the use of “ingression”. The reasoning behind this choice is unknown but perhaps an element of removing stigma may be at play. There may be parallels with what was spoken of in Cahill et al. (2007) where one individual felt embarrassed when using the item locator. This was attached to feelings of stigma. Stigma may play a bigger part of the lack of use of Assistive Technology than the literature currently suggests.

 It is possible that studies included in this review may be biased. Specifically, Lai Kwan et al. (2019) were examining their own products. This step is important for developing technologies, but the write-up of the examination may stem from a biased standpoint. Lai Kwan et al. (2019) reads similar to a promotional piece rather than a research article in some areas. For example, within the conclusion, there is no reference to flaws in the technology, there are only lists of the positive elements of their technology.

 Perhaps the strongest explanation for the lack of use of Assistive Technology within dementia care is the issue surrounding ageing individuals and their willingness to engage with technology. Though it has not been explicitly mentioned in the papers included in this review, it is an ongoing issue within the literature in this area. As Kadylak et al. (2020) noted, the lack of willingness of aging individuals to use emerging technology, yet – some are willing to use some technologies. Some Assistive Technology such as “digital home assistants, smart appliances, and Internet-connected cameras”. The lack of use seen within certain populations is unfortunate; however, populations are being introduced to technology earlier which means there is less of a fear to using technology when these populations are older as seen by König et al. (2018).

# Review Limitations

This review has a number of limitations. As it is a Rapid Structured Literature Review, some literature may not be included. According to Armitage et al. (2008), Rapid Structured Literature Reviews “would appear to be more appropriate to the conducting of small-scale literature-based research projects” (p. 1). This research may benefit from a larger Systematic Review in order to encompass all relevant literature. Perhaps utilising more databases could be a positive addition. Also, the thematic analysis was completed by one researcher, having more researchers may have resulted in alternative interpretations of the literature. For example, when conducting an intercoder reliability (ICR), the use of at least two coders is necessary. O’Connor et al. (2020) states, ICR helps qualitative research achieve this communicative function by showing the basic analytic structure has meaning that extends beyond an individual researcher. Finally, some studies may have been slightly outdated with regard to technology used and deployed. However, while still relevant, the issues and findings from older studies may have already been addressed, learnings from older studies may have been addressed by developers and in turn new issues can arise in newer studies. For example, the picture button telephone spoken about in the study by Cahill et al. (2017) would be outdated for care today so the literature within the current study has not included such technology.

# Further Research Directions

Several areas which could be explored and expanded on were identified throughout this review. Firstly, a more extensive look at all the literature, a larger sample size (by way of a systematic review) would be invaluable, perhaps with the inclusion of interviews or focus groups to ensure a more accurate and personal interpretation would be a positive addition. Similarly, the area of Assistive Technology and dementia care could be explored from a more cultural/social psychological perspective. This would allow for a refinement of approaches and technologies for specific areas and populations. It may also aid with the implementation of Assistive Technology at an earlier point. Another direction this area of research could take would be Assistive Technology and how it is perceived and used within other illnesses, disorders, and diseases. Teaching and learning aids for example is a large area of research that may benefit from a look at what works and what does not. Finally, a look at specific Assistive Technologies as opposed to many in one piece of research, a more in-depth look an individual Technologies and their uses and barriers within dementia care. Perhaps looking more into sensor technology as a diagnostic tool rather than an aid to care; such has been done by Malmgren Fange et al. (2019). However, as highlighted above, their study used more than just sensor technology (alarms also), the reduction of the volume of technologies examined, along with more focus on specific technologies, may be useful.

# Conclusion

This review brings together research in the area of Assistive Technology and Dementia care. Each study included in the review explored barriers and factors associated with the use and lack of use of Assistive Technology within dementia care. The studies ranged from 2007 to 2020. Each study included in the review found barriers to the use of Assistive Technology: some studies shared the same barriers with each other, such as awareness and technical difficulties. Other studies included in the review spoke of barriers that were specific to their own study such as ingression. The time at which technology is introduced and implemented into the care of an individual is important as it can aid the ease of use of certain technologies.

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