

Assistive Technologies for People with Dementia: Personal Review

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Chapter 2 Dementia, and Assistive Technologies

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2.1 Symptoms of Dementia and Pharmacologic Treatment

Number of Dementia Patients: With advances in medical technology, the average life expectancy of world population is increasing. Since the probability of becoming cognitively impaired increases with age, one side effect of increasing life expectancy is the emerging number of dementia patients (Huang et al., 2014). It is estimated by the year 2050 that 115.6 million people globally will have dementia (Fernandez, Arthur, & Fleming, 2013). Approximately 60% of people with dementia live in their own homes, generally with a spouse or other family member as their carers (Bonner & Idris, 2012). There has been a fundamental shift in healthcare policy in many first world economies to encourage and facilitate people with dementia to live longer at home, on the provision that their care situation is appropriate to need (Carswella, McCullagha, Augustoa et al., 2009).

Type of Dementia: The International Classification of Diseases, 10th revision (ICD-10) describes dementia as a syndrome typically characterized by chronic, often progressive disturbances in higher cognitive functions including memory, thought processing, orientation, comprehension, calculation, learning capacity, language and judgment (WHO, 2009; Yuill & Hollis, 2011). There are several etiologies for irreversible dementia such as Alzheimer's disease, vascular disease, Lewy Body disease etc (Hopper & Bayles, 2001). The most common types of dementia are Alzheimer's disease (AD) and vascular dementia (VaD) (Alzheimer's Society, 2009). According to the ICD-10, AD is a neurodegenerative cerebral disease with unknown etiology (WHO, 2009). It is primarily characterized by the accumulation of neurofibrillary tangles and amyloid plaques that damage neurons, altering brain function. The ICD-10 defines VaD as a progressive vascular disease resulting in small infarctions that have cumulative effects on brain function (WHO, 2009). The distinction between AD and VaD is not always clear. Most authorities consider the second most common etiology of dementia to be a coexistence of these two disorders known as mixed dementia, as pure VaD is uncommon (Patterson & Clarfield, 2003). Frontal lobe dementia affects mood which can lead to aggression and inappropriate behavior. Dementia with Lewy bodies is characterized by hallucinations, and muscle tremors and stiffness. Other forms of dementia include Creutzfeldt-Jakob disease (CJD), Huntington's disease, alcohol-related brain damage, and HIV/AIDS related dementia (Yuill & Hollis, 2011).

Pharmacological Treatment for Dementia: There are currently no treatments to reverse the course of dementia. However, pharmacological treatment do achieve a slowing of the impairment (Carrion, Aymerich, Baillés et al., 2013). Acetylcholinesterase inhibitors aim to improve the cognitive symptoms of AD and mixed dementia; however, the efficacy of these treatments remains limited. Recent systematic reviews on the use of acetylcholinesterase inhibitors have indicated that clinical trials tend to report small effects sizes; there is a lack of demonstrated clinical importance of such drugs, and evidence that they improve quality of life remains inconclusive (Qaseem et al., 2008; Rodda & Walker, 2009, Yuill & Hollis, 2011).

Pharmacological Treatment for BPSD (Fernandez, Arthur, & Fleming, 2013): BSPD has been suggested that over 50% of patients with dementia will experience behavioral and psychological symptoms of dementia (BSPD). Symptoms can include agitation, wandering, altered sleeping patterns, disinhibited behavior which may include inappropriate sexual behavior and harmful behaviors such as aggression. People with dementia exhibiting BSPD have some universal emotional needs that are often not fulfilled. These needs include: (1) being needed and feeling useful, (2) to be able to care for others, (3) having an increased sense of self-worth, (4) to love and be loved, and (5) to be able to convey their emotions without inhibition (Fernandez, Arthur, & Fleming, 2013).

BPSD is frequently treated with pharmacological interventions with antipsychotic medications being the treatment of choice. Concerns with the use of these medications include the risk of mortality, their side effects and their effectiveness in relieving Behavioral and Psychological Symptoms of Dementia (BPSD). Extra pyramidal symptoms, falls, gait disturbances, sedation, tardive dyskinesia and cerebrovascular incidents have been widely reported in literature associated with the use of antipsychotics

for people with BPSD. Living with dementia is not only distressing for the patient when they experience BPSD, it also has a negative impact on the quality of life of their carers. Evidence-based guidelines have therefore been developed to advise on prescribing requirements for these drugs (Fernandez, Arthur, & Fleming, 2013). The clinical value of pursuing non-pharmacological options as a first line approach is becoming increasingly recognized (Yuill & Hollis, 2011).

Symptoms and Progression of Dementia: Dementia, often referred to as a disease, is a process of transition from a healthy, active state to a dependent state with progressive loss of memory, functional skills and independence (Fernandez, Arthur, & Fleming, 2013). They cause a gradual deterioration in a wide variety of cognitive domains. Initial symptoms of dementia are subtle memory loss and forgetfulness, which progress to profound memory loss, cognitive dysfunction, and behavioral and emotional disturbances (Yasuda, Beckman, Yoneda, Yoneda, Iwamoto, & Nakamura, 2006). Memory Problems: loss of memory, particularly short term; forgetting of names of close friends and family; inability to recall the names and operation/purpose of devices and objects. Forgetting to eat, drink and take medication (Bonner & Idris, 2012). Wellbeing Related Problems: anxiety and even depression due to forgetfulness; confusion and disorientation in relation to the surrounding environment; anger and frustration.

People with AD lose the ability to store new memories, this impacts very directly upon their ability to participate in, and contribute to, a normal conversation. A fundamental problem for people with dementia, subsequently their caregivers, and relatives is the 'dehumanizing' effect engendered by this cognitive impairment (Gowans, Campbell, Alm, Dye, Astell, & Ellis, 2004).

Mild Cognitive Impairments (MCI; Hess, Dieberg, McFarlane et al., 2014): MCI, which is often a prelude to dementia, is also associated with disproportionate atrophy in the medial temporal and temporal cortices. The severity and extent of dementia-related atrophy increase as a function of time, destroying cognitive and functional abilities at each stage. This damage is irreversible and devastating to both the individual sufferers and their families or carers.

The Early Stages of Dementia (Clare & Woods, 2003; Yuill & Hollis, 2011): The early stages of dementia include difficulty learning, decreased ability to form new memories and significantly impaired episodic memory, whereas other types of memory such as semantic memory and procedural memory may remain relatively intact or mildly affected. For individuals with mild to moderate dementia, memory and cognitive difficulties often result in personal factors such as anxiety, depression, decreased self-confidence or motivation and withdrawal from activities.

The Mild to Moderate Stages of Dementia: In the mild to moderate stages, functional changes influence activity engagement; however, individuals still have some ability to learn new information or skills given the appropriate environmental conditions, support and patience (Clare & Woods, 2003). The severe stage consists of profound physical symptoms such as incontinence, significantly limited mobility, extremely impaired communication and dependence on others for all activities of daily living (Yuill & Hollis, 2011).

2.2 Evidence of Dementia Prevention theory & Brain Activation theory

Currently, there is no cure for dementia; therefore, it is paramount that researchers identify behavioral interventions that can prevent, attenuate, or impede the progression or genesis of this condition (Hess, Dieberg, McFarlane et al., 2014).

Can physical Exercise Prevent Dementia: Some types of exercise can have a beneficial influence on affective behavior. An exercise program seems to have a positive impact on mood. Studies examining the effects of physical activity on sleep were few but showed positive effects on both sleep quantity and quality, particularly in people with mild sleep disturbance. The exercise group showed improvements in stress-induced cardiovascular reactivity and self-reported sleep quality (Eggermont & Scherder, 2006). Physical activity that targets cardiovascular fitness may offer neuro-protective benefits and attenuate the neuronal structural and functional changes that are associated with MCI and dementia. The current literature reports that exercise in midlife by healthy adults increases cognitive functioning in various domains and reduces the likelihood of developing dementia later in life. The literature offers mild support for exercise as an attenuating or stabilizing intervention for certain cognitive domains.

Unfortunately, it is difficult to draw meaningful comparisons about the efficacy of physical activity from the current literature because inconsistencies exist across the studies, in terms of the intervention, neurocognitive outcome measure, statistical reporting method, and disease severity and associated levels of care (Hess, Dieberg, McFarlane, & Smart, 2014).

Evaluation: The spectrum of physical training interventions adopted in these trials included Tai Chi, flexibility, relaxation, balancing techniques, and varying intensities of aerobic exercise and strength training. Unfortunately, the notable variation in the modalities of physical intervention prevented speculation regarding which exercise modality was optimal. More attention and interaction may have influenced their motivation to perform on the tests and influenced the scoring of the global assessments. Because of the considerable variation in physical activity programs, it was not possible to draw any specific conclusions about which physical activity program was optimal. Therefore, future research should use a standardized approach to investigate and comparing the efficacy of different exercise modalities on cognitive performance.

Walking and Etiology of Dementia: Reduced physical activity can be an indirect consequence of dementia since motor function is affected in many of the dementias (Eggermont & Scherder, 2006). For example, in Alzheimer's disease (AD), extra pyramidal 'Parkinsonian' symptoms (rigidity, tremor and bradykinesia) have been observed (Prehogan & Cohen, 2004) and even in their absence impaired balance and reduced speed of walking is reported (O'Keefe et al., 1996; Pettersson, Engardt, & Wahlund, 2002). In Vascular dementia (VaD), walking speed is slower than in AD (Tanaka et al., 1995) and in subcortical ischemic vascular dementia (SIVD), gait disturbances such as decreased step length and gait apraxia with co-existing extrapyramidal symptoms are noted (Román, Erkinjuntti, Wallin et al., 2002).

2.3 Review of interventions and Rehabilitation for Dementia

Non-Pharmacological Interventions: There are currently no treatments to reverse the course of dementia. However, certain treatments, both pharmacological and psychotherapeutic, do achieve a slowing of the impairment, especially with regard to cognitive deficits related to dementia. Patients with dementia exhibit a wide range of cognitive dysfunctions as well as behavioral and mood changes, and as a result often require an individualized and multimodal treatment plan (Carrion, Aymerich, Baillés et al., 2013). Currently, there is no cure for dementia; The only way to relieve the situation is to assist the daily life of dementia patients (Hess, Dieberg, McFarlane, & Smart, 2014).

Cognitive Training: Research has demonstrated that maintaining a consistent pattern of frequent participation in cognitively stimulating activities is associated with reduced risk of developing dementia (Wilson et al., 2002; Yuill & Hollis, 2011). Regular participation in such activities may play a role in preserving the capacity of the brain to endure and compensate for neurodegeneration. Such a mechanism or "cognitive reserve" was described by Stern (2002) as the degree to which an individual is able to efficiently recruit alternative brain networks in order to optimize cognitive function following brain damage or pathology. Valenzuela and Sachdev (2005) found that higher cognitive reserves were associated with complex patterns of mental activity sustained throughout the life cycle and that increased mental activity in late life was associated with lower rates of dementia.

Interventions that target the cognitive and memory deficits and the associated difficulties with activities of daily living are the subject of ever-growing interest. Cognitive training and cognitive rehabilitation are specific forms of non-pharmacological intervention to address cognitive and non-cognitive outcomes (Bahar-Fuchs, Clare, & Woods, 2013).

Randomized Control Trials and Dementia (RCT; Bahar-Fuchs, Clare, & Woods, 2013): RCTs have long been regarded as the highest form of evidence in medical research because of the lower risk of bias associated with them. The present review is an abridged version of a Cochrane Review and aims to systematically evaluate the evidence for these forms of intervention in people with mild Alzheimer's disease or vascular dementia. Eleven RCTs reporting cognitive training interventions were included in the review. However, there is still no indication of any significant benefits from cognitive training. The results of the single RCT of cognitive rehabilitation show promise but are preliminary in nature.

Review of Dementia Rehabilitation: Rehabilitation is about 'enabling people who are disabled by injury or disease to achieve

their optimum physical, psychological, social and vocational well-being' (McLellan, 1991). This concept can be applied to people at different life stages and with different types of problems or disorders. In fact, Cohen & Eisdorfer (1986) argued that rehabilitation was the most appropriate framework within which to think about dementia care. Rehabilitation can focus on a range of different areas of need, and goals can be adjusted flexibly in response to changing needs

Occupational therapy for dementia: Occupational therapy encompasses everything individuals do to occupy themselves, including self-care, recreation, work and employment. The research also demonstrates that occupations remain highly valued and occupational priorities include maintaining independence with tasks and social interactions (Pettigrew, 2014).

A randomized control trial (RCT) found community occupational therapy sessions that included cognitive and behavioral interventions for individuals with mild to moderate dementia to be associated with improved functioning in daily activities, reduced caregiver burden and a higher effects size in comparison with drug trials or other psychosocial interventions (Yuill & Hollis, 2011).

The person who is occupied with an interesting task or activity will be happier, and less likely to become upset or agitated, than the person who is left alone and without any means of stimulation. Creative modifications to familiar activities have been shown to maintain interest in lifelong hobbies. For example, the former quilter may no longer be able to use a needle to sew but will still be interested in matching fabrics of different patterns and shapes (Bourgeois, 2007).

Drill and practice for memory deficits: In general, the research literature falls into several approaches to the remediation of memory deficits. The first approach is to attempt to restore memory through repetitive drill and practice (Sohlberg & Mateer, 2001). It is assumed that with repetitive drill and practice the brain will compensate; intact areas will take over the functions. Computer programs for retraining memory are based on the drill approach, but there is little evidence that gains in basic skills—such as attention, concentration, visual perception, simple memory, and organization generalize to functional daily-life activities (Sohlberg & Mateer, 2001). The current popularity of the “use it or lose it” theory by the general public is motivating people to do crossword puzzles, learn a new language, or memorize license plate numbers in order to prevent memory loss and dementia; the published research in this area is equivocal, however (Bourgeois, 2007).

The next approach to remedy memory disorders is to teach the person to use a strategy for remembering desired information. Some of the more common strategies include visual imagery (picture-name and face-name associations), mnemonics (phonetic system, loci method), and verbal elaboration strategies (story linking, first letter mnemonic,) (e.g., Fogler & Stern, 1988). These strategies provide an organizational structure for the information to be recalled and specific devices (or “tricks”) to use to access the information. Unfortunately, there is scant evidence that many of these strategies are effective in the long run. In fact, the use of a strategy can place heavy demands on the already disordered cognitive system and may not be a realistic approach for all persons with memory impairment (Bourgeois, 2007).

Cognitive rehabilitation and Cognitive training: The limited evidence that is currently available, mainly drawn from reports of single case experimental designs, suggests that cognitive rehabilitation interventions can produce significant improvements in targeted areas, at least for a proportion of participants. Clearly there is a great deal more work to be done here, but recent reviews are positive about the potential for cognitive rehabilitation (De Vreese, Neri, Fioravanti et al. 2001). Cognitive rehabilitation will not remove memory and cognitive problems, but it can make a considerable difference to quality of life and help people maintain involvement and well-being (Clare, Chapter to appear in M T Marshall (Ed), Think Rehab).

“Evelyn had a diagnosis of early-stage Alzheimer's disease. The strategy we decided on was to introduce a calendar. A central part of the intervention involved getting Evelyn into the habit of using her calendar. It was positioned in a prominent place, and Ed agreed to prompt Evelyn three times each day to look at her calendar and find out what day it was. This continued for three weeks, at the end of which Evelyn was using the calendar regularly and was able to explain what she needed to do in order to find out what day it was.” (Clare, 1999; Clare, Wilson, Carter, Hodges, & Adams, 2001; Clare, Wilson, Carter, & Hodges, 2003).

Compensatory memory aids: The compensatory approach to remedy memory deficits is to provide a compensatory system, or memory prosthesis, in the form of a memory aid or cues. Some compensatory systems substitute for a memory

function, such as an alarm clock, watch, or calendar; others perform a memory function, such as computer software and autodialing telephones. A prosthetic environment is one in which stimuli and cues evoke and reinforce appropriate functional behavior, such as labels on cupboards and signs on the bathroom doors. A wide variety of compensatory memory aids have been successful, including memory notebooks, bell timers and alarm clocks, written notes, shopping lists, tape-recorded messages etc. (Bourgeois, 2007).

Augmentative and Alternative Communication (AAC; Bourgeois et al., 2010): The basic goal of augmentative and alternative communication (AAC) is to help persons with communication impairments increase their participation in desired activities and create opportunities for social interaction through various modes of communication. AAC, especially high-tech computer-based and speech-generating devices, is most often used by individuals with severe oral-motor or expressive language impairments and is rarely considered for persons with dementia who continue to speak well into the late stages of their disease.

Speech-language pathologists, however, have been using various forms of AAC to support communication participation of persons with dementia. Many non-electronic or low-tech communication approaches have been used successfully to support social interaction of persons with dementia. AAC may include memory wallets, notebooks, calendars, signs, color codes, timers, communication boards, labels, and other tangible visible symbols that provide cues for interaction. Persons with dementia use AAC successfully, and SLPs may want to demonstrate to patients and caregivers the effectiveness of these tools. Also, various memory processes that remain relatively intact until later stages can be harnessed for maintaining desired behaviors, such as conversation.

2.4 Assistive Technology for Dementia

Assistive Technology: The Alzheimer's Society summarizes the benefits that "Assistive Technology can promote independence and autonomy, both for the person with dementia and those around them help manage potential risks in and around the home, reduce early entry into care homes and hospitals, facilitate memory and recall, reduce the stress on carers, improve their quality of life (*Alzheimer's Society Factsheet*, Bonner & Idris, 2012). Carswella, McCullagha, Augustoa et al. (2009) believe a major challenge for health care research will be to balance the lack of physical resources with a technological solution to aid people with dementia and their carers living at home and minimize potential hazards.

Low Tech Intervention (Bourgeois, 2007): Think of the memory aid as a prosthetic device to help the individual to remember better-like eyeglasses help people to see better, hearing aids help to hear better, canes to walk better, and dentures to eat better. Glasses, hearing aids, canes, and dentures provide valuable assistance with basic life functions (seeing, hearing, walking, and eating that are essential for maintaining a satisfactory quality of life.

Ours is busy, fast-paced world full of names, faces, places, facts, and figures to remember and use. We have appointments to keep, phone number to call, important facts to remember so many that we often experience memory overload. How many of us can function without our memory aids calendars, appointment books, shopping lists, Post-it notes, small scraps of paper in a coat pocket or at the bottom of a purse? Many manufacturers are taking advantage of our inadequate memories by offering technological substitutes, such as computers, calculators, personal digital assistants, and cell phones. In this age of computers, we depend on technology to augment our memory capacity. Similarly, he may have depended on the Global Positioning System (GPS) feature of his automobile but does not acknowledge the potential utility of the GPS for familiar locations around town.

High Tech Intervention: High tech intervention helps a person with cognitive or memory deficits function more independently in their daily life. A high-tech intervention is a compensatory strategy that helps a person to maximize their strengths and abilities. A high-tech intervention is computer-based system. It may also include additional devices such as a cell phone, pager, or digital camera.

Various Assistive Technology: The majority of older adults wish to live in their own homes, for as long as possible. This creates a growing interest in technologies to enable older people to remain living independently at home. Several publications

were identified about devices targeting social isolation (video-phonetic communication, affective orthotic devices or companion-type robots, personal emergency response systems), autonomy loss and cognitive disorders (wandering management systems, tele-monitoring) (Piau, Campo, Rumeau et al., 2014).

Broadly, assistive technologies fall into two wider categories, and they are 'Active' Devices and 'Passive' Devices. An active assistive device is one which requires the direct action of the user to make it work. Examples include remote control devices such as door motors, and even the pendant button of a social alarm. A passive assistive device is one which operates without the intervention of the user. A passive device will generally operate automatically in response to some external event. Examples include a fall detector, a flood sensor and a bed occupancy sensor. For the most part, assistive technologies utilized by those persons with dementia fall into the category of passive devices (Bonner & Idris, 2012).

The increase in the number and capabilities of devices to be connected is one of the central themes in the Internet of Things (IOT); smart devices can communicate with smart homes and smart cities via the Internet. Wireless communication networks (i.e. cell phone networks, mesh networks, WiFi networks) essentially connect end users with a city's network to provide assistance in public transportation, medical appointments and socialization activities, for example (Peterson, Prasad, & Prasad, 2012).

While the AD patient is in the early stages, they can live independently using cognitive aids, such as a pager or tablet, to assist in task remembrance. Such devices will only be useful for the AD patient with the ability to use the technology. Nygard, Pantzar, Uppgaard et al., (2012) found that when "mild cognitive impairment (MCI) is involved, the AD patient often found it difficult to use or understand how to use everyday technology" (Willis, & Price, 2014). Lancioni et al. (2009) found that "behavioral intervention in promoting activities of daily living (ADL's) through computer-mediated verbal instruction that required little to no effort on the part of the patient proved to increase the overall independence of the AD patient" (Willis & Price, 2014)

Various Stages of dementia and AT (Yasuda, 2007): Memory loss is the main symptom of Alzheimer's disease and related conditions. These memory disorders manifest themselves as a deficit in processing information and an inability to retrieve information when it is needed and make effective use of it. For example, a person who is no longer able to locate the toilet becomes incontinent. The best way of helping people with this condition is therefore to provide them with information as and when they need it. Memory aids must thus be designed, or commercially available computer equipment adapted, to facilitate their access to this information.

Yasuda (2007) have developed various non-electronic devices as memory aid tools (bracelet-type note pads, bolo tie-type note pads, memo presenters in front of eyes etc). Yasuda (2007) have also tried to support some daily behaviors for individuals living at home by using some electronic devices (e.g. Sony IC recorder, ICD-PX240). By automatic outputs of voice instructions and music with the IC recorder, we have successfully decreased wandering, subdued agitation, increased food intake etc. Additionally, a doll with utterance function and video movies with reminiscent pictures for individuals were used as well. As a result of those trials, an important point to note is that indispensable information or music should be given to the individuals before anxious behaviors may occur.

Most people with dementia enjoy talking, with the exception of the worst affected, and a videophone would enable them to contact volunteers at any time of the day or night. Regular conversations may significantly reduce the frequency of the behavioral and psychological symptoms of dementia and enhance psychological stability, and this would in turn reduce the burden borne by caregivers.

2.5 Assistive Technology and progression of Dementia

Evaluation for AT: Review of the extant literature reveals few clinical studies specifically involving persons with dementia (Bharucha et al., 2008). There is little general awareness of what devices are available, and what benefits they can bring (Bonner & Idris, 2012). Intervention-duration must be tested continually, given that AD is a degenerative disease and cognitive impairment could change the results of the interventions (Willis, & Price, 2014).

Refusal of AT: In a 2006 research report on the attitude of older people to TV, radio, the Internet and mobile/portable

devices, the majority of older people were classified as reluctant participants. (Mulvenna, Doyle, Wright et al., 2011). It is an unfortunate fact that AT in its many forms can fall very easily into disuse, despite its very real beneficial features. A review document in The Netherlands (2003) showed that there can be a 'fall-off' of use of up to 75% for a variety of reasons. The main factors for non-use relate to: Poor assessment of client needs; Inappropriate choice of equipment; Lack of client support and instruction; Lack of carer/family support and instruction; Lack of continuous support for client and/or carer; Equipment not meeting clients and carers expectations and/or needs (Bonner & Idris, 2012). The acceptance of a digital assistive device by a person with dementia is a process that begins with identifying and personalizing the functions of the device according to individual needs, and then supporting the usage and the gradual integration of the device into daily life (Karlsson, Axelsson, Zingmark et al., 2011).

Ethical Issues and AT: A person with dementia may reject the installation of surveillance technology because he does not see any reason for its installation. On the other hand, a family carer may find this necessary to improve the safety of the person with dementia (Topo, 2009). The level of cognitive impairment directly affects whether the AD patient is competent or incompetent to make decisions regarding which technologies they will permit into their homes and lives. Corvol et al. (2012) found in their research on "ethical issues in case management of the gerontology patient that there was a conflict in principles when what was beneficial for the patient conflicted with the respect for patient autonomy" (Willis & Price, 2014).

A classic example is the ethics of using bed, chair or door sensors to determine the movements of a 'wanderer', along with a GPS location tag-. One of the key questions is who is the ultimate beneficiary of the use of the technology? There is no doubt that a full-time family carer will benefit from alarms, alerts and location devices, as they contribute to both the carer and the cared for being able to live a more normal life, as well as giving the carer the chance for some respite with peace of mind (Yuill & Hollis, 2011).

The Costs and Benefits of AT: Bowes, Dawson, & Greasley-Adams (2013) reviewed to identify and assess evidence regarding the costs and benefits of assistive technology in supporting people with dementia. Assistive technology is often portrayed as offering huge potential for the future. However, the cost effectiveness study (Henderson et al 2013) suggested that the addition of tele-health to the care regime was not cost effective. The findings appear contradictory in that reductions in hospital admissions should save costs: however, there is a possibility that tele-health is shifting costs from secondary health services to primary care (Bowes, Dawson, & Greasley-Adams, 2013).

Assistive technologies that facilitate formal care at home, such as memory support systems, monitoring tele-health, and GPS systems show potential to support people with dementia to stay at home, and therefore may be cost effective. Several notes of caution need to be considered however: technology can promote further isolation of people already excluded from social interaction if it is a substitute for human contact; some technologies, especially those which offer surveillance and monitoring require sensitive evaluation of potential intrusiveness and threats to autonomy; some technologies have been designed without input from users and may reflect the needs of service providers rather than people with dementia (Bowes, Dawson, & Greasley-Adams, 2013).

Carers' burden and AT: Risk of caregiver distress increases when care recipients experience escalating behavioral symptoms, withdraw from social interactions or begin to demonstrate a pattern of reduced participation in activities previously considered meaningful (Yuill & Hollis, 2011). A systematic review ICT conclude that better supported carers will be able to care longer at home, and that therefore entry to institutional care for people with dementia can be delayed. Cheng and Zhuang (2010) consider that early detection and diagnosis could potentially reduce healthcare costs, as well as facilitating effective support for people with dementia. It is widely reported that the costs of care at home are lower than the costs of institutional care. Informal carers make a very significant contribution to care at home, and few studies take into account the total social cost of care, including items such as the costs of carers being out of the labor market (Bowes, Dawson, & Greasley-Adams, 2013).

European Research Project (1999) provided a tool for practitioners in dementia care to assess the benefits and drawbacks of AT use when supporting a client. The Alzheimer's Society has outlined similar considerations as regards the appropriate use of

AT. For example, the fear that assistive technology may be used to cut back services and reduce human contact. Inevitably, utilizing AT can also be perceived as a means of reducing levels of care and care costs.

2.6 Policy for Assistive Technology

The use of reminder systems e.g. medication: The use of home security and social alarm systems—for example, smoke and heat detectors, alarm systems and crime surveillance, as well as monitors that pick up any unexpected changes to an older person's routine. In July 2005, the Department of Health published 'Building Tele care in England' where it emphasized how: 'Tele care offers the promise of enabling thousands of older people to live independently, in control and with dignity for longer' (Bonner & Idris, 2012).

The announcement of the Preventative Technology Grant (PTG) was the first real suggestion that AT may finally be considered as a mainstream care option. The PTG undertaking was due to commence in April 2006. A similar initiative was launched in Scotland in the same year. The Whole System Demonstrator (WSD) published its outline findings in December 2011. The main disclosures were that the use of tele health and tele care equipment and support services in the trial areas indicate a 45% reduction in mortality rates, a 20% reduction in emergency hospital admissions and a 15% reduction in attendances to accident and emergency departments (Bonner & Idris, 2012).

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