Gibson G, Newton L, Pritchard G, Finch T, Brittain K, Robinson L.

[The provision of assistive technology products and services for people with dementia in the United Kingdom.](#)

Dementia 2016, 15(4), 681-701.

Copyright:

This is the authors' accepted manuscript of an article that has been published in its final definitive form by Sage Publications, 2016.

DOI link to article:

<http://dx.doi.org/10.1177/1471301214532643>

Date deposited:

13/09/2016

This work is licensed under a [Creative Commons Attribution-NonCommercial 3.0 Unported License](#)

Title: The provision of Assistive Technology products and services for people with dementia in the United Kingdom

Corresponding Author.

Dr Grant Gibson PhD. Institute of Health and Society. Newcastle University. Baddiley Clarke Building. Richardson Road. Newcastle Upon Tyne. Tyne and Wear. United Kingdom. NE2 4AX. Tel +44 (0)191 608 6777. Email grant.gibson@newcastle.ac.uk

Co authors.

Dr Lisa Newton, Institute of Health and Society. Newcastle University.

Dr Gary Pritchard, Institute of Health and Society. Newcastle University.

Dr Katie Brittain, Institute of Health and Society. Newcastle University.

Professor Louise Robinson, Institute of Health and Society. Newcastle University.

Title: The provision of Assistive Technology products and services for people with dementia in the United Kingdom

Abstract

In this review we explore the provision of Assistive Technology (AT) products and services currently available for people with dementia within the United Kingdom. A comprehensive review of all known AT products and services currently available highlighted 171 products or product types, and 331 AT services. In addition we collected data the amount and quality of information provided by AT services alongside AT costs. We identify a range of products available across three areas; AT used 'by', 'with' and 'on' people with dementia. AT provision is dominated by 'telecare' provided by local authorities, with services being subject to major variations in pricing and information provision, and few using currently available resources for AT in dementia. We argue that greater attention should be paid to information provision about AT services across an increasingly mixed economy of dementia care, including primary care, local authorities, private providers and local/national AT resources.

Keywords

Assistive Technology; Dementia; information provision; Telecare; United Kingdom

Introduction

As population ageing creates new economic, social and health demands, increasing attention is being paid to the role Assistive Technology (AT) can play in the care of older people living with dementia.

For the purposes of this review, we use the following definitions for AT and telecare (Table 1).

Assistive Technologies <ul style="list-style-type: none">• “Any device or system that allows an individual to perform a task that they would otherwise be unable to do, or increases the ease and safety with which the task can be performed.” (Royal Commission on Long Term Care 1999)• Does not only refer to electronic equipment; can refer to quite simple devices such as calendar clocks or assistance with activities of daily living Telecare <ul style="list-style-type: none">• Devices used to facilitate independence and enhance personal safety• Telecare includes community alarms, sensors and movement detectors, and the use of video conferencing to communicate with carers
Table 1. Definitions of Assistive Technology and telecare

The UK is currently the leading European nation in the adoption of telecare, with 1.7 million current users spending £106 million in 2010, and with a projected spend of £251 million in 2015. (Kamalasekar 2010; Goodwin 2010; Deloitte 2013). Other countries are also rolling out AT at scale; for example Pols (2010) describes telecare as a ‘hot topic’ within the Netherlands, while the United States also has a well-developed private market for AT, as recognised in the Assistive Technologies Act 1998 (AT Act) (<http://www.ataporg.org/history.html>) (Robinson *et al* 2013).

Despite growing national and international interest, the evidence base for AT has been largely limited to small local trials of individual devices or individual disease populations (Goodwin 2010; Fry & Buse 2013; Greenhalgh *et al* 2013). In England, the Whole Systems Demonstrator randomised controlled trial (WSD); the largest trial of telecare and telehealth in the world to date was an attempt to address this lack of evidence by examining the clinical and cost effectiveness of telecare and telehealth in three long term illnesses (Diabetes, Chronic Obstructive Pulmonary Disease and Heart Failure) (Steventon *et al* 2012). Initial study findings, promoted vigorously by the UK Government indicated that telecare and telehealth led to significant reductions in mortality rates and admissions into secondary care

(Steventon *et al* 2012). However these initial findings have been complicated by later papers reporting the full results of the WSD trial, which found that telehealth had no significant effects on health-related quality of life (Cartwright *et al* 2013), and were not cost effective (Henderson *et al* 2013), while telecare failed to reduce uptake of health and social care services (Steventon *et al* 2013). In addition, difficulties with implementing AT as part of a ‘whole system’ approach has also been reported (Hendy *et al* 2012). Despite these concerns, UK health and social care policy is now largely focused upon ‘mainstreaming’ AT through initiatives such as DALLAS (Delivering Assisted Living Lifestyles at Scale) and 3 Million Lives (Department of Health 2005; 2006; 2009; 2012).

Within UK dementia care, policy has developed based on assumptions that AT can reduce caregiver burden (McHugh *et al* 2012), sustain cognitive and functional abilities (Jensen *et al* 2011; Gillespie, Best & O’Neill 2012), encourage ‘ageing in place’ (Brittain *et al* 2010) and lead to significant cost savings by delaying entry into residential or nursing care (Duff & Dolphin 2007). In contrast, comparatively little attention has been paid to how AT can support well-being or quality of life (Scherer 1996; Orpwood *et al* 2007; Orpwood *et al* 2010; Windle 2010). Also reflecting the wider evidence base, research on AT in dementia has been made up of relatively small trials suggesting that AT can lead to significant benefits and/or cost savings (Woolham & Frisby 2002; Burrow & Brooks 2012). A significant commercial market has also grown to support AT services, with a small yet growing subsector beginning to sell AT products directly to the public. A number of information resources such as the Telecare Services Association, Telecare Aware and AT Dementia have also emerged which offer guidance on AT to service commissioners, health and social care professionals and to the wider public. Given the developing state of AT services in dementia, questions can be asked about how well key stakeholders in dementia care, including both health and social care professionals and people with dementia are informed about AT, and how easily they can access both AT services and information about AT products. The goal of this review paper is therefore to critically explore the current range and scope of AT products and services available within the UK, alongside sources of information about their usage, availability and cost. By doing so, we hope to provide a state of the art knowledge

synthesis which will enable health and social care providers in dementia care to better facilitate knowledge transfer about this topic to people with dementia and their families.

Methods

To ascertain the current ‘state of the art’ of AT in dementia, we carried out a comprehensive review of AT products and services currently available in dementia care. This review involved two searches. We first conducted a search of AT products either routinely available within dementia services, or available to purchase privately. Using a snowball approach, this search began with two information resources; ATdementia.org.uk (Burrow & Brooks 2012) and AT guide (www.asksara.org.uk) (Woolham 2011; Savitch *et al* 2012). This in turn led to further resources, including websites for individual products, AT directories, charitable organisations, collaborative projects between the public and private sector, retail sites and product catalogues of major AT manufacturers (table 2).

Table 2. List of data sources used in AT product search	
Social Care Institute for Excellence (SCIE) www.scie.org.uk/publication	<ul style="list-style-type: none"> List of available AT resources book exploring telecare and quality of life in people with dementia; free download from www.dementiashop.co.uk Links to guides such as “Telecare and Dementia”
Assistive Technology Dementia websites www.atdementia.org.uk	<ul style="list-style-type: none"> Searchable databases of AT products Assistive technology guide with examples of how technology can be used to help people live well with dementia. In-built questionnaire to identify solutions according to individual need. Hosts ‘AT guide’ jointly with disability living foundation
Alzheimer’s Society www.alzheimers.org.uk	<ul style="list-style-type: none"> General information and catalogue of ATs Sells a small range of AT products; mainly for communication and activities of daily living
Foundation for Assistive Technology www.fastuk.org	<ul style="list-style-type: none"> Leaflets and presentations on AT for carers and health care professionals FAST includes a list of exhibitions on its online listing of AT events.
Telecare aware www.telecareaware.com	<ul style="list-style-type: none"> News and information service for people interested in AT, telecare and telehealth.
Disabled Living Foundation www.dlf.org.uk/ www.asksara.org.uk	<ul style="list-style-type: none"> Advises on general aids and funding. Website, telephone helpline and follow up service to help public and practitioners identify different equipment

	<ul style="list-style-type: none"> • AT guide; a website providing advice about daily living for older people, including AT products
Assist UK http://assist-uk.org/	<ul style="list-style-type: none"> • Demonstrates and provides information about a varying range of equipment across the country.
More Independent www.moreindependent.co.uk	<ul style="list-style-type: none"> • Local information directory about AT services for Merseyside. • Includes links to AT for private purchase
Housing and Telecare Learning and Improvement Networks	<ul style="list-style-type: none"> • National network supporting local service redesign through the application of telecare and telehealth. • Telecare LIN also provides Google Maps based resource of all Local Authority and private AT services within the UK
Local Authority AT services	<ul style="list-style-type: none"> • 245 Local Authority (City council, district council, county council) websites and information sources were reviewed. • Local Authority sites includes information on local AT services, available forms of AT, information on eligibility and referral, and costs.
Local Housing providers	<ul style="list-style-type: none"> • 49 housing providers (housing associations, housing trusts) listed as providing AT systems • Includes information on AT types, eligibility criteria and cost
Online stores selling AT products	<ul style="list-style-type: none"> • Online stores selling AT to service providers and the public. Examples include: healthandcare.co.uk; betterlifehealthcare.co.uk; cobolt.co.uk; qedonline.co.uk; thedisabledshop.com
Commercial providers	<ul style="list-style-type: none"> • 38 private companies providing AT products

A second search identified current AT services within the United Kingdom. Our search began with an AT service database maintained by the UK Telecare Learning and Improvement Network (Telecare LIN 2013). The network maintains a publically available resource of UK AT services by locality, provided by a mix of Local Authorities, NHS trusts, housing associations and private companies. Each service in this database was reviewed to ascertain the range of AT products/services available, their cost and the amount and quality of information provided about each service. After reviewing any information provided on service websites and via any literature regarding products, costs and referral pathways, each service was classified using the following scheme:

- 1 Minimal information about AT or AT services; usually limited to a brief description and service contact details, with little to no information about available products, service costs or referral pathways.

- 2 Detailed information about AT services and levels of service available; usually also includes information about service costs and referral pathways, and may include photographs and descriptions of individual AT products.
- 3 As 2 but also including literature which could be easily made available to service users and other professionals; these could include product catalogues, installation guides or instruction manuals.
- 4 As 3 but also including multimedia and/or interactive information about AT services. These may include individual case studies of AT products or users, interactive animations or infographics (for example an interactive 'smart house'), video footage of AT products/services or links to other AT resources.

Because we were only interested in currently available products we excluded any literature describing design prototypes, technology specifications or research in progress (for reviews of such products see Carrillo *et al* 2009; Department of Health 2013). We also excluded generic AT products and mobility aids such as walking sticks and aids, grab rails, hoists or similar devices. Because most routine AT services are available to people with a number of health conditions, we did not restrict our search to AT services exclusively for dementia. However we did identify whether people with dementia were identified as a specific client group, and whether any dementia specific products were provided by these services.

Results

AT products for People with dementia

Our AT product search identified 171 products or product types. We organised these products into eleven categories according to their overall purpose and function; these categories were then arranged into three overall themes (fig 1);

- Devices used **by** people with dementia – supportive and responsive products that people retained control over, or which helped people complete their everyday activities.
- Devices used **with** people with dementia – supportive devices which encourage, support or enable communication, engagement or play with others.
- Devices used **on** people with dementia – including telecare, these were responsive devices which monitored people and their activities. Requiring little direct involvement from the person with dementia, these products could alert a carer or tele-operator in an emergency, or could lessen or prevent the risk of harm to an individual.

It is important to note that these categories are not mutually exclusive, certain devices could fit into different themes depending on their underlying technology and how they are used in practice (for example a ‘telecare’ alarm could also provide many people with valuable social contact through a tele-operator (Milligan *et al* 2011)). Products were therefore organised according to their overall design goals, or how they were marketed within their accompanying literature.

Devices used by people with dementia

These products were used ‘by’ people with dementia; to help people with their everyday activities, to orient to time and space, or to communicate with others. Five product categories are highlighted:

Time and place orientation. Given difficulties with time and place orientation, many devices helped people with dementia tell the time or locate themselves in space (Torrington 2009). Most common were large face clocks which were easier for people with dementia to read. However many of these products gave the time in digital format, in Roman numerals or as dates in numerical format (e.g. dd/mm/yyyy) unsuitable for people with dementia. The ‘day clock’ (www.day-clock.com) had been designed specifically for people with dementia, and gave the time in an inexact but easily understood format; as a period of the day (e.g. ‘its Thursday morning’). Place orientation included simple room signage or lights which activated upon movement or ambient light levels, or furniture which allowed contents to be easily seen. Predominantly found in residential care environments, these products could also be used in people’s own homes but were rarely marketed for this purpose.

Prompting & reminder devices. Several devices aided memory by giving electronic prompts or reminders. The most common designs were a recordable ‘Dictaphone’ which could record voice memos, or simple pill dispensers available from most pharmacies (Mediboxes). More complex dispensers had an integrated alert and when connected to telecare systems could lock and unlock automatically, and could raise an alert if doses were missed (Hopkins 2005). These dispensers have been demonstrated as a cost effective means of promoting adherence to medication, and of reducing

medication related hospital admissions (Improvement and Efficacy Partnership 2012). However difficulties with learning and recognition combined with often complex designs can mean many of these products are difficult for people with dementia to use without help (Hopkins 2005).

Communication aids. Many products adapted landline and mobile telephone technology so that they were easier for people with dementia to use. Many such phones are inexpensive and readily available in high street stores, but were only offered by a few AT services. Landline and increasingly mobile 'photo' phones attached photographs to speed dial buttons, allowing calls to be made either by a single button press or by touching an image on screen. More specialist phone designs removed the numeric keypad, instead limiting calls to pre-selected numbers via a speed dial function. Their limited functionality made them easier to use, but in several cases they no longer looked like phones, which could potentially affect their recognition (Stephens, Cheston & Gleeson 2012).

Aids for activities of daily living. A small range of simple, often low cost products helped people with dementia complete household activities. Interestingly, many of these products had characteristics that made them particularly suitable for people with dementia but were not routinely available through AT services. Examples included cutlery and crockery in brightly coloured plastics, making them easier to recognise and safer to use. Electronic household products included television remote controls or simplified radios with fewer, clearer buttons, which could give people continued access to leisure activities.

Alerts and alarms. Central to most telecare systems, alerts and alarms are the most common form of AT in dementia. What differentiated these alarms from 'telecare' was that they helped people with their daily activities rather than just alerting them to danger. Examples of such products were 'boil alerts', a metal disc which when placed in boiling liquid would rattle to gain a person's attention, easy to use kitchen timers to help with cooking or the 'magiplug', which could automatically drain water from a sink or bath and which also changed colour according to temperature. Most of these products were inexpensive, required little to no installation and had wider benefits beyond people with

dementia. However they were only rarely available through AT services, instead these products were sold through dementia charities.

Devices used with people with dementia

The smallest range of products identified in our review gave opportunities for social interaction, for creative play or helped people to express themselves and communicate with others. Products covered three major areas:

Communication aids. These objects had the goal of promoting verbal communication between people with dementia and those around them. Most of these systems were marketed towards residential care environments, or towards professionals looking after people in later dementia who were losing their verbal skills. Examples include Talking Mats (www.talkingmats.com) a card based communication tool which can assist people with communication difficulties, including dementia to make choices or put across their opinions, allowing them to remain involved in decisions about their care (Murphy *et al* 2007).

Play and enjoyment. Several products promoted enjoyment through individual or group play. A few were 'high tech' commercial products sold to the general population, such as the Nintendo 'DS' and 'Wii' video games consoles. However most were simple and inexpensive games and puzzles, or promoted art and creative activities. Such games often form the basis for music, art, reminiscence or cognitive stimulation therapies (Spector *et al* 2003; McDermott *et al* 2012; Beard 2012). Products such as a sensory cushion also drew on the principles of snoezelen in using touch, sound and light to stimulate a range of sensory experiences (Ball & Haight 2005).

Reminiscence aids. Many products promoting social interaction did so by encouraging reminiscence activities. Examples included generic photographic books evoking past events, or historic objects which could create a themed environment and a familiar sense of place. Such products could be in paper form, or be interactive, using video, music and animations or promoting sensory experiences

through touch, taste or smell. Most were generic (the 50s, 'the old days'), but some could tailor activities to an individual's interests. Other products such as the 'life book' used personal photographs or music to create an individualised biographical reminiscence tool. These provide a powerful, person focused medium for reminiscence, but required time and sensitivity from carers in order to gain their full benefit.

Devices used 'on' people with dementia.

The most common forms of AT in terms of sheer number of products, these devices are described as working 'on' people with dementia. They required little to no input from the person and brought little direct benefit to people's abilities, but could monitor their activities, give other people access to them, or could dissuade, limit or prevent people with dementia from doing things (Mort *et al* 2013). Three product themes are highlighted:

'Telecare' systems. The form of electronic AT receiving arguably greatest attention within UK health and social care policy, a typical telecare service comprised a basic community alarm, which could be expanded with movement, pressure, moisture or magnetic sensors connected via the internet to a carer or call centre, who could then contact a person should an alarm be triggered or if activity levels fall outside a series of pre-determined norms. Telecare systems were often modular and could be expanded as needs grew, for example by adding further sensors/alarms as new problems arose. Most telecare systems were only available via social/health services, but a small yet growing number of services were also available to purchase or rent privately. Many telecare systems, although marketed towards people with dementia, may be confusing or difficult for them to use or even recognise (Hopkins 2005; Orpwood *et al* 2010).

Location monitoring services. A subset of 'telecare' products used Global Positioning System (GPS) or mobile telephone technology to locate and 'track' the geographical position and movements of a person with dementia. Such products usually comprised a GPS locator within a bespoke device,

integrated into a mobile phone, or disguised as a belt, watch or piece of clothing. Devices could identify a person's location on the screen of a phone or bespoke device, via GPS co-ordinates or by marking a position on an online map. Mobile phone based services were also available which could triangulate a person's mobile phone position via a phone call or website. Such services depended on the person owning and carrying a phone, but cost only a few pence per call or a few pounds for a monthly subscription. In contrast bespoke GPS products could cost several hundred pounds.

Safety and security. Also subsumed within 'telecare', a major goal of AT in dementia is to improve the safety and security of individuals by monitoring and where necessary restricting people's activities (Orpwood *et al* 2007). The simplest products disguised elements of the home (e.g. covering plug sockets) or automatically operated other objects by a timer. 'Keysafes' were attached to the external wall of a property, and could give carers or emergency services quick access to house keys. Usually part of telecare systems, water or gas shut offs could detect and stop any gas appliances or water flows in a home before alerting a carer. Wearable fall detectors could detect a sudden change in orientation and raise an alert. Although a common feature of telecare systems, how often these devices are used within routine services, such as falls management is unclear (Brownsell & Hawley 2004; Ward *et al* 2012). In addition false alarms have been repeatedly highlighted as a problem in such products, a factor which may limit their use by either people with dementia or by social care services (Roberts *et al* 2012). A subset of location services could also alert the person with dementia, either by asking if they really wanted to go outside, or by informing a carer if a person attempted to pass through a given doorway or outside a pre-determined geographical boundary. Such products could be coercive if misused; for example to restrict people's freedom of movement (Robinson *et al* 2007; Landau & Werner 2012; Mort *et al* 2013). Finally two commercially available services could screen telephone calls, preventing cold calls by diverting or cancelling any telephone calls not on a pre-approved list.

Range and scope of AT service providers

Our second search identified 331 UK AT services, the majority being provided by Local/Unitary Authorities, with housing providers or private companies providing most of the rest (see Table 3).

Table 3. AT providers and types of AT service						
	LOCAL AUTHORITY	HOUSING PROVIDER	CHARITY	NHS TRUST	PRIVATE COMPANY	Total
Total number of services	245	48	1	2	35	331
Community alarms	244	47	1	2	33	327
Community alarms and telecare	196	25	0	2	29	252
Telehealth	5	0	0	0	4	9
Stand alone AT products	15	2	0	0	7	24
GPS location services	3	0	0	0	2	5

Only two services could be found which were solely provided by NHS trusts. While many NHS trusts referred to and collaborated with social care providers to provide AT services, these services were usually managed through Local Authorities. Of 331 services 327 provided community alarms; 252 of these also offered telecare. A small but significant minority of Local Authorities (48) provided community alarms but no telecare service, although several of these also indicated that they were planning to expand their provision to include telecare in the near future. Barlow *et al* (2012) note that a mixed economy in AT, including private purchase is also likely to be a large part of the future AT landscape. However although growing private provision of AT remains a small sector of the market; 35 individual private providers were found, most offering community alarm (33) or community alarm and telecare services (29). Private provision was dominated by services offering products from a small selection of medium to large companies including Tynetec, Just Checking Tunstall, the current UK market leader supplying most Local Authority AT services. During this study the telecommunications

company O2 also launched the Help at Hand service through their website and high street stores. However this service was withdrawn after only 4 months, citing poor awareness and slow uptake as reasons for its closure (telecare aware 2013). AT which were not part of telecare or community alarm systems, including stand-alone AT products or GPS monitoring and location devices were only rarely offered by services; only 3 Local Authority services advertised GPS monitoring equipment as part of its service, while only 15 offered a range of stand-alone AT products such as simple to use telephones, memory aids or aids to assist with activities of daily living. Despite a number of products currently being available, providing AT with actually assists people with dementia with continuing their activities of daily does not appear to be a priority for AT services, and therefore remains a key gap in current AT provision in dementia.

Information provision about AT services

Table 4. information provision by AT services					
	Minimal information	Detailed information about individual products	Detailed information and literature	Detailed multimedia information about services	Total
Local Authority	113	46	76	12	247
Housing association	13	11	18	5	60
Charity	1	0	0	0	1
Private company	5	20	7	3	35
NHS trust	1	1	0	0	2

The amount, type and quality of information provided about AT was highly variable (see Table 4). Given Local Authorities were the most common AT provider, they played a key role in disseminating information about AT. However the amount and quality of information provided by Local Authorities

varied significantly; although more than half gave detailed information, the highest proportion (113) gave only minimal information about their service. Detailed information was provided by 76 Local Authority services, usually in the form of a leaflet about the service. Only 12 Local Authority run services, 5 housing associations and 3 private companies provided information in the form of videos, case study vignettes from previous telecare users or links to AT databases and resources. Although there are several useful external resources for AT available, these appear to only rarely be used by services at the frontline of AT delivery. Private companies were more likely to provide detailed information about their products; this is perhaps unsurprising given their need to 'sell' their services and ultimately to make a profit. Where services did give literature about AT to the public, this information was also of variable quality. Some gave detailed information about products, although several services did so using a generic pro-forma provided by a well-known telecare manufacturer with only the contact details of the local service being different. However many only provided basic guides with contact details, which in many cases did not allow people to make an informed decision, or even an initial insight into how AT could potentially help them in their individual case.

We also examined whether people with dementia and their carers were identified as a target group within the information provided about AT. AT services can be used by a wide range of groups including those with a range of chronic illnesses or at risk of domestic violence, however people with dementia have been highlighted as a particular priority for AT deployment. Despite this, our review found that only 65 of 331 AT services (19.8%) specifically mentioned people with dementia, cognitive impairment or memory problems as being potential beneficiaries of AT services, or gave any specific information about how AT could benefit them. Sites such as AT Dementia and the Alzheimer's Society gave specific information about the use of AT in the case of dementia, however these were not routinely referred to by AT services. The reasons for this are currently unclear (Burrow & Brooks 2012). Given the role that AT can potentially play in dementia care, the failure of many AT services to promote AT as a means to assist people with dementia and their carers is likely to limit their use amongst this key group.

AT costs and charges

It is also worth considering the financial costs of AT in dementia care. In the UK, the current mixed economy of AT services is predominantly provided through social care rather than health care, meaning most people have to make a financial contribution towards any AT services. Where available, we therefore collected data on the charges made for AT services, alongside data on where devices could be purchased and their purchase price. We did not conduct a cost-effectiveness analysis as part of this review, rather our concern is with how service costs are communicated to potential users.

Of the 331 services identified in this review, more than half (187) failed to give any information about pricing on their websites or in their promotional literature. All private providers and housing associations, and almost all social care services charged for AT services, although notably 8 Local Authorities currently made their services free to eligible individuals. For those that did give information about costs, a complex and potentially confusing picture of charging regimes emerges, involving installation costs, weekly, monthly or quarterly rentals, monitoring costs, additional call out charges, varying charges across different geographical areas and further assessment requirements for those in financial difficulty. Mean cost per week for a basic community alarm package was £3.62 (range £0.00 - £10.63), not including initial installation costs. An expanded telecare service cost £10-£20 per week, depending on the number of sensors installed and whether home care support was included. Individual charging policies within Local Authorities meant costs for a service could vary greatly, with the same service being significantly more expensive or even unavailable in some parts of the country. Those with certain disabilities including dementia were eligible for reductions, for example through the removal of Value Added Tax (VAT), or in some cases being able to access services for free. However individuals also had to undergo a separate assessment to receive these reductions; information on the eligibility criteria and application process for any reductions were not routinely provided, were unclear, could vary by locality and were subject to frequent changes.

Our review revealed two predominant charging models for AT services. Both were rental based, and provided either a standard telecare 'package' set for different levels of need, or a modular, 'pay as you go' approach with charging for individual devices. Many standard packages offered differing levels of service with a varying pricing structure depending on what was offered. In contrast 'pay as you go' services allowed people to build their own systems, with each additional sensor or device being charged separately. Services which contacted a nominated carer for assistance were significantly less expensive than those that provided wardens or home care staff who could respond in an emergency. Indeed in several services home visits led to significant extra charges, for example charging £70 for an emergency call out; an issue which could potentially dissuade people from using their alarm system. Further research is required to ascertain how far AT charging models differ between local services, the reasons behind these charges and their consequences both for the continuing development of AT services and for users.

Given the continuing growth of a private market for AT, we also examined the pricing models for products available through private purchase. The cost of these products varied hugely; small objects could cost a few pounds while telecare or GPS services could routinely cost several hundred pounds. As with social care provision, most services were relatively 'high technology' and therefore high cost telecare solutions, with less attention being paid to simple labour saving devices or aids and adaptations. Many private services were also available for rental in addition to private purchase, resulting in charges similar in range and scope to those in social care. The simplest, cheapest and most widely available devices could benefit from the larger economies of scale that came from being 'mainstream' products, but were not routinely offered by AT services. In contrast, although often using now mature technologies the niche nature of many electronic AT products could make them prohibitively expensive for private purchase, meaning for many, they will only be accessible through formal services. Many AT services have the potential to be carried out by over-the-counter products, although the failure of the O2 help at hand services raises questions about how a future private market for AT may develop, for example based around 'apps' for current and future smartphones, tablets and

other networked devices, rather than through bespoke AT products. Such products point towards an expanded role for a mixed economy for AT provision, in which health/social provision is supplemented by private purchase. However it is also important to note that older people's knowledge of rapidly advancing consumer technology trends, health and income inequalities which limit access to these increasingly widely available technologies, and more restrictive access criteria within social care will also bring about significant challenges to people's ability to access AT within this economy.

Discussion

This review shows that the current market for AT products in dementia care in the UK is highly fragmented, with significant differences in access to services; in service charges; in product availability and in information provision. The current focus on telecare, driven by policy objectives in which AT is seen primarily as a means to improve safety and security while reducing costs has left relatively little room for a wider use of technology in dementia care, for example using AT to enable social interaction or to support activities of daily living (Orpwood *et al* 2007; Thygesen & Moser 2010; May *et al* 2011). A substantial number of products highlighted in this review, such as easy to use cutlery, reminiscence games or big button telephones can be beneficial in promoting independence, well-being and quality of life, but are only rarely available within current AT services. Instead these products have to be bought from a private market for which there is poor public awareness (Van Den Heuvel *et al* 2012). Further, despite their ubiquity, there are few examples of now easy to implement technologies such as video calls (e.g. Skype) being made available via commercial AT products. More attention therefore needs to be paid to the scope of AT beyond telecare, including pre-existing technologies and low technology approaches within mainstream dementia care, how these could best be implemented, and how public awareness of AT can be improved.

Given limited public awareness of AT, how people with dementia, and health and social care practitioners access information on AT is as important as what types of AT are currently available. Our review finds major differences in the amount and quality of information provided by AT services. Just under half of AT services failed to give any meaningful information about AT, and with a few exceptions AT services generally gave little information about products outside their own remit. Instead it appears to be largely left to people themselves to search for the small number of information resources such as 'AT Dementia', 'Mick's House' or 'Ask Sara', or for dementia charities, advocacy organisations, product manufacturers and informal networks of carers to share knowledge about products. These are useful resources, but are rarely signposted by mainstream AT services; a lack of general awareness about the existence of these resources is therefore a key gap. However anecdotal reports suggest that this may be changing; for example Burrow & Brooks (2012) describe increasing internet traffic to the AT dementia service, suggesting health and social care professionals are increasingly referring their patients to the AT dementia website. Such reports illustrate the important role that these information resources can play in disseminating knowledge about AT to all stakeholders in dementia care. Attention therefore needs to be paid to how current services use these resources in order to better inform current and future potential AT users, and how these resources can be supported in the future.

Where people access information about AT is also an important question. Here information sources were focused on social care services, or directories which required a certain amount of knowledge about what dementia resources are available. However for many, primary care will act as the first point of contact regarding AT services, meaning that how information about AT is communicated to health care professionals, and how they pass it on to their patients is a key issue. When compared to social care, knowledge of AT and particularly its use in dementia, is far less developed among health care professionals (Siota & Simpson 2008). Historically primary care has not seen AT and telecare as a priority; a lack of awareness and enthusiasm about AT amongst primary care professionals has been repeatedly identified as a key barrier to uptake (Clark & McGee-Lennon 2011; Sanders *et al* 2012; Van

Den Heuvel *et al* 2012; Corbett-Nolan & Bullivant 2012). GPs currently receive little specialist training about dementia and no training about AT. Within primary care knowledge of the evidence base for AT, what products are available or their referral pathways is therefore limited. With the implementation of the 2012 Health and Social Care Act (HM Government 2012) responsibilities for commissioning services within England have been transferred from Primary Care Trusts to Clinical Commissioning Groups (CCG's), meaning GPs will play a much greater role in the future provision and uptake of AT. Scotland and Wales also have their own arrangements, further complicating the policy landscape for AT services. How AT can be 'sold' to primary care more widely, especially in dementia care, is open to debate but will require a combination of stronger evidence about effectiveness; greater communication of this evidence to key stakeholders; effective forms of information dissemination about what ATs are available and how they can be used; guidance about how primary care services can access AT's or refer to AT services; and information on how AT can be better integrated into existing care pathways. Achieving this is a significant challenge for health and social care systems, as illustrated in the Whole Systems Demonstrator trial in which integration of health and social care services via remote care in a 'whole system' approach largely failed to take place (Hendy *et al* 2012). Therefore, rather than whole scale service redesign, such improvements should take place through incremental changes sensitive to local contexts, local expertise and local partnerships through which services are delivered. Finally, work on informing health care professionals about AT should also include ATs beyond telecare, such as the range of occupational, activity and social aids highlighted in this review.

A mixed economy in which the private sector sells products directly to people with dementia and their carers will also be a feature of the future AT landscape (Barlow *et al* 2012). Our study found that at present, the market for AT's for private purchase outside of health/social care provision was still very small, with poor public awareness, few resources to inform the public and professionals and few providers offering services outside of health and social care all being a feature. In addition, the development of a private market was dealt a blow during the period of this study with the launch and

subsequent closing 4 months later of the O2 ‘help at hand’ and ‘health at home’ services; the first significant attempt to sell AT via a retail model through high street stores (Telecare aware 2013). Anecdotally, suggestions for the failure of this service include slower than expected uptake, poor awareness amongst the general public, with reports suggesting low sales amongst high street partners and resistance to technology among health care commissioners, particularly given the controversies surrounding the results of the Whole Systems Demonstrator trial. What this closure means for the further development of a mixed economy of telecare provision is uncertain. Although it is likely that the private market will continue to play a growing part in future AT provision, the failure of this product suggests that public awareness and health service enthusiasm for AT may still be too low to support products outside of health/social services (Hendy *et al* 2012; Deloitte 2013). How all stakeholders can be better informed about AT and telecare services, both more generally and in the area of dementia therefore needs further consideration.

Currently, social care recipients are expected to make a financial contribution to their care, including any AT services they receive. In any future provision of AT, it is also likely that a growing proportion of service costs will be met by individuals rather than the state (Duff & Dolphin 2007; Knapp *et al* 2013). Our review reveals significant differences in charging models and service costs across the UK. At a mean cost of £3.62 per week, a basic community alarm service may be considered to be relatively affordable, but the costs of a full telecare system could quickly escalate, with prices increasing to £10-£20 per week for a full system including home response services. In many cases AT will be but one part of a wider care package; the price of AT alongside any further care costs, for example domiciliary care, is also likely to influence uptake. When compared to the current UK state pension of £110.15 per week, telecare costs will make up a significant proportion of many older people’s incomes, and can be potentially unaffordable for those unable to gain financial assistance through other means. We found that the majority of services failed to inform potential users of how much services would cost at the outset, with many services also failing to tell people what AT was available or how to get hold of it. Such issues may lead to a situation in which those with greatest need are excluded from AT

provision; either because they cannot afford the charges set by social care or private providers, because they are not signposted to services, because AT products are not available in a given locality, or simply because they do not know what's available. How far a 'postcode lottery' exists in AT provision, its effects, and how this postcode lottery can best be negotiated therefore require further research.

It is important to note the limitations of our review. Given the continuing pace of technological development, any review of AT products and services will quickly go out of date. We have used multiple sources of information about AT in order to review the current landscape for AT in dementia care. However the rapidly changing nature of service provision and paucity of comprehensive AT resources means that it is possible that several AT products, services or resources have been missed from our review. In addition, several Local Authority sites provided out of date information, for example in their listed prices. It is therefore possible that many AT services provided more (or indeed less) services than listed, new services may have come online which have not been included in our review, or prices may have changed. Our review is also limited to products available in the UK. The UK has adopted AT to a greater degree than many other European countries. It is therefore possible that several of the products noted above may be unavailable, or may not be widely used in other countries. Our searches indicate that similar or alternative technologies are being used in other countries; examples include MedicAlert®, Alzheimer's Association Safe Return® and ComfortZone in the USA (<http://www.alz.org/care/alzheimers-dementia-gps-comfortzone.asp>), the 'Safe to Walk' system in Australia (<http://www.safe2walk.com.au/>), and the 'Paro' robotic seal from Japan (www.parorobots.com). However differing cultural attitudes towards dementia care may mean technologies are used differently in other countries, in ways that are less acceptable across differing cultural contexts (Shibata & Wada 2011). Care therefore needs to be taken when applying these findings to other countries adopting AT.

Conclusion – recommendations for practice

Drawing on the findings of this review, in order to support greater public awareness of AT and its role in dementia care we suggest that greater attention needs to be paid to how information and support about a wide range of AT can be best provided across both an increasingly mixed economy of dementia care and a new NHS organisational structure, with clinical commissioning at its heart. Existing resources such as AT dementia play an important role in informing people and health and social care services about AT; this role should be expanded and thus may require increased support and greater financial assistance. In addition, greater attention needs to be paid to educating health professionals about such existing resources as primary care plays an increasing role in dementia care, so that AT may be more widely used in a proactive way before people access social services assistance. Further attention also needs to be paid to the growing significance of private provision of AT, its implications for a mixed economy of AT services, the role that information provision and awareness campaigns will have to play in this mixed economy, and the ethical and practical implications that privately provided AT products and services will bring.

Declaration of Conflicting Interests

None Declared

References

- Ball, J., Haight, B. (2005) Creating a multisensory environment for dementia: the goals of a Snoezelen room *Journal of Gerontological Nursing* 31 (10) 4-10
- Barlow, J., Curry, R., Chrysanthaki, T., Hendy, J., Taher, N (2012) *Remote care plc: developing the capacity of the remote care industry to supply Britain's future needs* Retrieved from http://www.haciric.org/static/pdf/publications/HaCIRIC_%20Remote_Care_Report_061212.pdf
- Beard, R. (2012) Art therapies and dementia care: a systematic review *Dementia* 11 (5) 633-656
- Brownsell, S., Hawley, M. (2004) Fall detectors: do they work or reduce the fear of falling *Housing, care and support* 7 18-24

Burrow, S., Brooks, D. (2012) ATdementia: an information resource on assistive technologies that help support the independence of people with dementia *Dementia* 11 (4) 553-557

Cartwright, M., Hirani, S., Rixon, L., Beynon, M., Doll, H., Bower, P., Bardsley, M., Steventon, A., Henderson, C., Rogers, A., Sanders, C., Fitzpatrick, R., Barlow, J., Newman, S. Effect of telehealth on quality of life and psychological outcomes over 12 months (Whole systems demonstrator telehealth questionnaire study); nested study of patient reported outcomes in a pragmatic, cluster randomised controlled trial *British Medical Journal* Retrieved from <http://www.bmj.com/content/346/bmj.f653>

Clark, J., McGee-Lennon, M. (2011) A stakeholder-centred exploration of the current barriers to the uptake of home care technology in the UK *Journal of Assistive Technologies* 5 (1) 12-25

Corbett, Nolan, A., Bullivant, J (2012) *summary briefing of care and support at home: an audit of telecare services in England* London: Good Governance institute. Retrieved from <http://www.good-governance.org.uk/Downloads/5846-WEB%20GGI%20Summary%20Briefing%20Telecare%20Audit.pdf>

Deloitte Centre for Health Solutions (2012) *Primary Care: Working differently. Telecare and telehealth –a game changer for health and social care* London: Deloitte. Retrieved from <http://www.deloitte.com/assets/Dcom-UnitedKingdom/Local%20Assets/Documents/Industries/Life%20Sciences/uk-ls-telehealth-telecare.pdf>

Department of Health (2005) *Building telecare in England*. London: Department of Health. Retrieved from http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4115644.pdf

Department of Health (2006) *Our Health, our care, our say; a new direction for community services*. London: Department of Health. Retrieved from http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4127604.pdf

Department of Health (2009) *Living well with dementia: a national dementia strategy*. London: Department of Health Retrieved from http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_094051.pdf

Department of Health (2012) *Prime Minister's challenge on dementia* Retrieved from http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_133176.pdf

Department of Health (2013) *Research and development work relating to assistive technology 2012-2013* Retrieved from <https://www.gov.uk/government/publications/assistive-technology-for-disabled-and-older-people-research-and-development-work>

Duff, P., Dolphin, C. (2007) cost-benefit analysis of assistive technology to support independence for people with dementia – part 2. Results from employing the ENABLE cost-benefit model in practice *Technology and Disability* 19 (2-3) 79-90

Gillespie, A., Best, C., O'Neill, B. (2012) Cognitive Function and assistive technology for cognition: a systematic review *Journal of the International Neuropsychological Society* 18 (1) 1-19

Goodwin, N. (2010) The state of telehealth and telecare in the UK: Prospects for integrated care *Journal of Integrated Care* 18 (6) 3-10

Greenhalgh, T., Wherton, J., Sugarhood, P., Hinder, S., Procter, R., Stones, R. (2013) What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare *Social Science and Medicine* 93 86-94

HM Government (2012) *Health and Social Care Act* Retrieved from <http://www.legislation.gov.uk/ukpga/2012/7/contents/enacted>

Henderson, C., Knapp, M., Fernandex, J.L., Beecham, J., Shashivadan, P., Cartwright, M., Rixon, L., Beynon, M., Rogers, A., Bower, P., Doll, H., Fitzpatrick, R., Steventon, A., Bardsley, M., Hendy, J., Newman, S. (2013) Cost effectiveness of telehealth for patients with long term conditions (whole system demonstrator telehealth questionnaire study); nested economic evaluation in a pragmatic, cluster randomised controlled trial *BMJ* 346

Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., Bower, P., Bowen, R., Fitzpatrick, R., Bardsley, M., Newman, S. (2012). An organisational analysis of the implementation of telecare and telehealth: the whole systems demonstrator *BMC Health Services Research* 12 403-424

Hopkins, P (2005) The use of technology to help patients with self-medication *Nursing Times* 101 (32) 24

Improvement and Efficiency partnership (2012) *The automated pill dispenser project* Retrieved from <http://www.westmidlandsiep.gov.uk/index.php?page=604>

Jensen, L., Maanson, I., Holthe, T., Hurnasti, T., Gudnadottir, T.(2009) How assistive technology support cognitive disability, secure active living for persons with dementia and enhance new interfaces between formal and informal care in the area of dementia *Assistive Technology Research Series* 25 222-227

Kamalasekar, S. (2010) *European Remote Patient Monitoring Market* London: Frost & Sullivan. Retrieved from <http://www.frost.com/sublib/display-report.do?bdata=aHR0cDovL3d3dy5mcm9zdC5jb20vcHJvZC9zZXJ2bGV0L3JlcG9ydC1icm9jaHVyZS5wYWw%2FaWQ9TTVEQi0wMS0wMC0wMC0wMEB%2BQjEhY2tAfkAxMzYzODY1NjlxNzg2&id=M5DB-01-00-00-00>

Landau, R., Werner, S. (2012) Ethical aspects of using GPS for tracking people with dementia. Recommendations for practice *International Psychogeriatrics* 24 (3) 358-366

- May, C.R., Finch, T.L., Cornford, J., Exley, C., Gately, C., Kirk, S., Jenkins, K.N., Osborne, J., Robinson, A.L., Rogers, A., Wilson, R., Mair, F.S. (2011) Integrating telecare for chronic disease management in the community. What more needs to be done? *BMC Health Services Research* 11 131
- McDermott, O., Crellin, N., Ridder, H.M., Orrell, M (2012) Music therapy in dementia: a narrative synthesis systematic review *International Journal of Geriatric Psychiatry* 28 (8) 781-794
- McHugh, J., Wherton, J., Prendergast, D., Lawlor, B. (2012) Identifying opportunities for supporting caregivers of persons with dementia through information and communication technology *Gerontechnology* 10 (4) 220-230
- Milligan, C., Roberts, C., Mort, M. (2011) Telecare and older people: who cares where? *Social Science and Medicine* 72 (3) 347-354
- Mort, M., Roberts, C., Callen, B. (2013) Ageing with telecare: care or coercion in austerity *Sociology of Health and Illness* 35 (6) 799-812
- Murphy, J. Gray, C., Cox, S. (2007) Talking mats: the effectiveness of a low technology communication framework to help people with dementia express their views *Journal of Assistive Technologies* 1 (2) 30-34
- Orpwood, R., Sixsmith, A., Torrington, J., Chadd, J., Chalfont, G. (2007) Designing technology to support quality of life of people with dementia *Technology and disability* 19 (2-3) 103-112
- Orpwood, R., Chadd, J., Howcroft, D., Sixsmith, A., Torrington, J., Gibson, G., Chalfont, G. (2010) Designing technology to improve quality of life for people with dementia: user led approaches *Universal Access in the information society* 9 (3) 249-259
- Pols, J (2010) telecare: what patients care about. In Mol, A., Moser, I., Pols J. (eds) (2010) *Care in practice: on tinkering in clinics, homes and farms* (pp 171-194) London UK: Transcript
- Roberts, C., Mort, M., Milligan, C. (2012) Calling for care: disembodied work, teleoperators and older people living at home *Sociology* 46 (3) 490-506
- Robinson, L., Hutchings, D., Corner, L., Finch, T., Hughes, J., Brittain, K., Bond, J. (2007) Balancing rights and risks: conflicting perspectives in the management of wandering in dementia *Health, Risk and Society* 9 (4) 389-406
- Robinson, L., Gibson, G., Kingston, A., Newton, L., Pritchard, G., Finch, T., Brittain, K (2013) Assistive Technologies in caring for the oldest old: a review of current practice and future directions *Aging Health* 9 (4) 365-375
- Royal Commission on Long Term Care (1999) *With Respect to old age: long term care – rights and responsibilities*. London: Department of Health Retrieved from <http://www.archive.official-documents.co.uk/document/cm41/4192/4192.htm>
- Sanders, C., Rogers, A., Bowen, R., Bower P., Hirani, S., Cartwright, M., Fitzpatrick, R., Knapp, M., Barlow, J., Hendy, J., Chrysanthaki, T., Bardsley, M., Newman, S.P. (2012) Exploring barriers to

participation and adoption of telehealth and telecare within the Whole System Demonstrator Trial: a qualitative study *BMC Health Services Research* 12 (1)

Savitch, N., Brooks, D., Wey, S. (2012) AT guide: developing a new way to help people with dementia and their carers find information about assistive technology *Journal of Assistive Technologies* 6 (1) 76-80

Scherer, M. (1996) Outcomes of assistive technology use on quality of life *Disability and Rehabilitation* 18 (9) 439-448

Shibata, T., Wada, K. (2011) Robot therapy: a new approach for mental healthcare of the elderly – a mini review *Gerontology* 47 (4) 378-386

Siota, R., Simpson, C. (2008) Applying telecare in dementia: what psychiatrists need to know *Advances in Psychiatric treatment* 14 (5) 382-388

Spector, A., Thorgrimsen, L., Woods, B., Royan, L., Davies, S., Butterworth, M., Orrell, M. (2003) Efficacy of an evidence based cognitive stimulation therapy programme for people with dementia: randomised controlled trial. *British Journal of Psychiatry* 183 248-254

Stephens, A., Cheston R., Gleeson, K. (2012) An exploration into the relationships people with dementia have with physical objects: an ethnographic study *Dementia* Retrieved from <http://dem.sagepub.com/content/early/2012/03/21/1471301212442585.abstract>

Steventon, A., Bardsley, M., Billings, J., Dixon, J., Doll, H., Beynon, M., Hirani, S., Cartwright, M., Rixon, L., Knapp, M., Henderson, C., Rogers, A., Hendy, J., Fitzpatrick, R., Newman, S. (2013) Effect of telecare on use of health and social care services: findings from the Whole Systems Demonstrator Cluster randomised trial *Age and Ageing*. Retrieved from <http://ageing.oxfordjournals.org/content/early/2013/02/25/ageing.aft008.full.pdf+html>

Telecare Aware (2013) *O2 to stop selling telecare and telehealth in the UK* Retrieved from <http://telecareaware.com/o2-to-stop-selling-telecare-telehealth-in-the-uk/#comments>

Thygesen, H., Moser, I (2010) Technology and good dementia care: an argument for an ethics-in-practice approach. Schillmeier, M., Domenech, M. (2010) (eds) *New technologies and emerging spaces of care* (pp 129-148) Farnham UK: Ashgate

Torrington, J. (2009) The design of technology and environments to support enjoyable activity for people with dementia *Alter* 3 (2) 123-127

Van Den Heuvel, E., Jowitt, F., McIntyre, A. (2012) Awareness, requirements and barriers to use of Assistive Technology designed to enable independence of people suffering from Dementia *Technology and Disability* 24 (2) 139-148

Ward G., Holliday, N., Fielden, S., Williams, S. (2012) Fall detectors; a review of the literature *Journal of Assistive Technologies* 6 (3) 202-215

Windle, G. (2010) Does telecare contribute to quality of life and well-being for people with dementia? *Journal of Dementia Care* 18 (5) 33-36

Woolham, J., Frisby, B. (2002) Building a local infrastructure that supports the use of assistive technology in the care of people with dementia *Research, Policy and planning* 20 (1) 11-24

Woolham, J (2011) The AT guide self-assessment tool under development at www.atdementia.org.uk
Journal of Assistive Technologies 59 (1) 26-28