



## LOTI Research - Assistive Technology in Social Care

Research conducted for the London Office of Technology and Innovation  
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### Objective

This research review has been carried out in order to help the London Office of Technology and its boroughs understand and gain visibility of the breadth and quality of existing cases studies available online on the use of Assistive Technologies.

### Background

Assistive devices and technologies are those whose main purpose is to maintain or improve a person's functioning and independence to facilitate participation and to enhance overall well-being.<sup>1 2</sup>

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<sup>1</sup> <https://www.who.int/disabilities/technology/en/>

<sup>2</sup> Appleyard, Richard (2005). "Disability Informatics." In: Consumer Health Informatics. Ed. by Deborah Lewis et al. Health Informatics. Springer New York, pp. 129–142.

LOTI's primary interest is in *digital* ATs, for example, text-to-speech software, voice assistants like Amazon Alexas, smart watches, Internet of Things-enabled fall-alarms, motion detectors.

It is estimated that around 20% of men and 30% of women aged 65 years and above currently require care and support with at least one activity of daily living (ADL), such as bathing and dressing.<sup>3</sup> Many people wish to remain in their own homes, which creates challenges for a stretched system limited by funding, yet facing increasing social care costs and increased burden on informal carers.<sup>4 5</sup>

Digital assistive technology has potential to support and enhance the lives of those in need of social care in the UK. However there is a limited and inconclusive evidence base for AT despite its use by UK councils.<sup>6</sup>

### **Smart homes and smart home technology**

12 studies of smart home assistive technology were included in the review, these explored assistive technology used in a home environment including integrated devices such as pressure, light and movement sensors,<sup>7</sup> and smart-adapted appliances such as mirrors and toilets<sup>8</sup>, for example using voice-activated controls.<sup>9</sup>

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<sup>3</sup> Later Life in the United Kingdom. Age UK. 2019. URL: [https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/later\\_life\\_uk\\_factsheet.pdf](https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/later_life_uk_factsheet.pdf)

<sup>4</sup>Abdi S, de Witte L, Hawley M Emerging Technologies With Potential Care and Support Applications for Older People: Review of Gray Literature JMIR Aging 2020;3(2):e17286

<sup>5</sup> <http://www2.paconsulting.com/rs/526-HZE-833/images/Robotics%20in%20Care%20report.pdf>

<sup>6</sup> Lucy Brims & Kathryn Oliver (2019) Effectiveness of assistive technology in improving the safety of people with dementia: a systematic review and meta-analysis, *Aging & Mental Health*, 23:8, 942-951,

<sup>7</sup> Turjamaa, R, Pehkonen, A, Kangasniemi, M. How smart homes are used to support older people: An integrative review. *Int J Older People Nurs*. 2019; 14:e12260.

<sup>8</sup> Mayer P, Güldenpfennig F, Panek P. Towards Smart Adaptive Care Toilets. *Stud Health Technol Inform*. 2019;260:9-16. PMID: 31118313

<sup>9</sup> Davit Marikyan, Savvas Papagiannidis, Eleftherios Alamanos, A systematic review of the smart home literature: A user perspective, *Technological Forecasting and Social Change*, Volume 138, 2019, Pages 139-154,

Four of these studies include use of smart home technologies in a care home, sheltered housing or assisted living facilities.<sup>10 11 12 13 14</sup>

In terms of study type and quality, two of the included studies were systematic reviews and two were randomised trials with control groups, which represent 'level 1' research evidence.<sup>15</sup> Smart home technology can be effective, for example one systematic review found that 66.66% (12/18) of studies reported that the smart homes and home health-monitoring technology showed advantages in terms of improved clinical outcomes compared to no intervention or other types of interventions.<sup>16</sup> Although no studies in the review improved or reduced frailty or falls risk.<sup>17</sup> A subsequent randomised control trial (RCT) did report a reduction in falls for older people living in an assistive technology enabled care home facility where sensors and alerts were used.<sup>18</sup>

The rest of the studies include prototype or usability testing, anecdotal case studies as well as a non-systematic review. Some provide useful insight into experience of use of the smart home technology for example that older people may not perceive they have a need for the technology<sup>19</sup> and may in fact avoid using it in order to

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<sup>10</sup> Nauha L, Keränen NS, Kangas M, Jämsä T, Reponen J. Assistive technologies at home for people with a memory disorder. *Dementia* (London). 2018 Oct;17(7):909-923.

<sup>11</sup> Lauriks S, Meiland FJM, Oste JP, Hertogh C, Droes RM. Effects of Assistive Home Technology on quality of life and falls of people with dementia and job satisfaction of caregivers: results from a pilot randomized controlled trial. *Assistive technology* 2020; 32(5): 243-250.

<sup>12</sup> <https://www.salixhomes.co.uk/news/pioneering-smart-home-technology-keep-older-people-safe-their-homes-piloted-salford> Accessed 09.11.2020

<sup>13</sup> Rantz M, Phillips LJ, Galambos C, Lane K, Alexander GL, Despina L, Koopman RJ, Skubic M, Hicks L, Miller S, Craver A, Harris BH, Deroche CB. Randomized Trial of Intelligent Sensor System for Early Illness Alerts in Senior Housing. *J Am Med Dir Assoc*. 2017 Oct 1;18(10):860-870.

<sup>14</sup> <https://www.youralcove.com/blogs/news/use-of-alcove-caretech-enables-outstanding-cqq-rating-in-housing-association-disability-scheme> Accessed 10.11.2020

<sup>15</sup> [https://www.elsevier.com/\\_\\_data/promis\\_misc/Levels\\_of\\_Evidence.pdf](https://www.elsevier.com/__data/promis_misc/Levels_of_Evidence.pdf)

<sup>16</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform*. 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

<sup>17</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform*. 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

<sup>18</sup> Lauriks S, Meiland FJM, Oste JP, Hertogh C, Droes RM. Effects of Assistive Home Technology on quality of life and falls of people with dementia and job satisfaction of caregivers: results from a pilot randomized controlled trial. *Assistive technology* 2020; 32(5): 243-250.

<sup>19</sup> Turjamaa, R, Pehkonen, A, Kangasniemi, M. How smart homes are used to support older people: An integrative review. *Int J Older People Nurs*. 2019; 14:e12260.

distance themselves from a label of disability<sup>20</sup> or to maintain their competence.<sup>21</sup> In general, greater inclusion of the end user's (generally older people) needs and preferences is called for, and seems to now be incorporated in ongoing work such as Albyn's Fit Homes, which are 'co-produced'.<sup>22</sup> Alcove's use of assistive technology in supported living which is tailored to the user's needs,<sup>23</sup> and the ongoing Assistive Technology and Telecare to maintain Independent Living At home for people with dementia (ATILA) study which is not included here as is yet to report outcomes.<sup>24</sup>

In all the studies technical processes and dependencies are not well reported - although in general the technology needs to be configured and personalised. Much of the research seems to have been hampered by technical issues and problems with connectivity<sup>25 26 27 28</sup> or issues of discontinued use, for example when the devices need charging.<sup>29</sup>

Again, service processes are not well described in any of the studies. In general it seems that facilitation and training is required for both users, health professionals and carers. It's important to consider the context of these technologies, particularly where time and skill from health professionals or caregivers is required, for example Rantz et al found that nurses did not have enough consistent access to an interface

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<sup>20</sup> Turjamaa, R, Pehkonen, A, Kangasniemi, M. How smart homes are used to support older people: An integrative review. *Int J Older People Nurs.* 2019; 14:e12260.

<sup>21</sup> Mayer P, Gldenpfennig F, Panek P. Towards Smart Adaptive Care Toilets. *Stud Health Technol Inform.* 2019;260:9-16. PMID: 31118313

<sup>22</sup> <https://techousing.co.uk/fit-homes/> Accessed 10.11.2020

<sup>23</sup> <https://www.youralcove.com/blogs/news/use-of-alcove-caretech-enables-outstanding-cqq-rating-in-housing-association-disability-scheme> Accessed 10.11.2020

<sup>24</sup> <http://www.isrctn.com/ISRCTN86537017>

<sup>25</sup> Mayer P, Gldenpfennig F, Panek P. Towards Smart Adaptive Care Toilets. *Stud Health Technol Inform.* 2019;260:9-16. PMID: 31118313

<sup>26</sup> Lauriks S, Meiland FJM, Oste JP, Hertogh C, Droes RM. Effects of Assistive Home Technology on quality of life and falls of people with dementia and job satisfaction of caregivers: results from a pilot randomized controlled trial. *Assistive technology* 2020; 32(5): 243-250.

<sup>27</sup> Astaras, Alexander & Lewy, Hadas & James, Christopher & Katasonov, Artem & Ruschin, Detlef & Bamidis, Panagiotis. (2015). Unobtrusive smart environments for independent living and the role of mixed methods in elderly healthcare delivery: The USEFIL approach.

<sup>28</sup> Rantz M, Phillips LJ, Galambos C, Lane K, Alexander GL, Despains L, Koopman RJ, Skubic M, Hicks L, Miller S, Craver A, Harris BH, Deroche CB. Randomized Trial of Intelligent Sensor System for Early Illness Alerts in Senior Housing. *J Am Med Dir Assoc.* 2017 Oct 1;18(10):860-870.

<sup>29</sup> Astaras, Alexander & Lewy, Hadas & James, Christopher & Katasonov, Artem & Ruschin, Detlef & Bamidis, Panagiotis. (2015). Unobtrusive smart environments for independent living and the role of mixed methods in elderly healthcare delivery: The USEFIL approach.

to check the alerts they received about patients.<sup>30</sup> Where there are problems with ongoing use of technology greater facilitation and support may be needed.

Cost, savings and return on investment are rarely reported. Liu et al cite two studies of smart home technology that report cost-savings,<sup>31</sup> However these were published before 2015 and not included here. Rantz et al analysed cost effectiveness of an intelligent sensor system for early illness detection versus control, but did not find significant differences in costs.<sup>32</sup> Liu et al's systematic review found that in general, technologies used in these studies are high-cost, for example requiring a large amount of sensors<sup>33</sup> as well as extensive training and maintenance. Liu et al<sup>34</sup> suggest that using low cost technology could result in higher levels of technological readiness. A study of smart technology installed in assistive housing in Manchester uses low-cost off the shelf technologies that require no technological knowledge from the user, however this study is still ongoing and has not yet reported any outcomes<sup>35</sup>.

Liu et al and colleagues<sup>36</sup> conclude from their systematic review of smart home technologies that in general the level of technology readiness is low. For example some are still at a prototype stage and the technology has only been tested with

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<sup>30</sup> Rantz M, Phillips LJ, Galambos C, Lane K, Alexander GL, Despina L, Koopman RJ, Skubic M, Hicks L, Miller S, Craver A, Harris BH, Deroche CB. Randomized Trial of Intelligent Sensor System for Early Illness Alerts in Senior Housing. *J Am Med Dir Assoc*. 2017 Oct 1;18(10):860-870.

<sup>31</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform*. 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

<sup>32</sup> Rantz M, Phillips LJ, Galambos C, Lane K, Alexander GL, Despina L, Koopman RJ, Skubic M, Hicks L, Miller S, Craver A, Harris BH, Deroche CB. Randomized Trial of Intelligent Sensor System for Early Illness Alerts in Senior Housing. *J Am Med Dir Assoc*. 2017 Oct 1;18(10):860-870.

<sup>33</sup> Turjamaa, R, Pehkonen, A, Kangasniemi, M. How smart homes are used to support older people: An integrative review. *Int J Older People Nurs*. 2019; 14:e12260.

<sup>34</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform*. 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

<sup>35</sup> <https://www.salixhomes.co.uk/news/pioneering-smart-home-technology-keep-older-people-safe-their-homes-piloted-salford> Accessed 10.11.2020

<sup>36</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform*. 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

small sample sizes and no control groups used.<sup>37 38 39 40</sup> Where there is more robust research longer term measurement and follow-up is needed.<sup>41</sup>

## Robotics

11 studies included here describe the use of robots in social care, this includes robots for providing physical, social and cognitive assistance.

Three systematic reviews, two randomised control trials (RCTs) and one quasi-experimental study provide good evidence of the effectiveness of 'social robots', particularly for older people with dementia or cognitive impairment in residential settings. There is evidence that social robots can improve emotional state, increase mood, increase verbal engagement, pleasure, sleep and reduce agitation, anxiety, stress and depression in this population.<sup>42 43 44 45 46 47</sup> The robotic seal '[PARO](#)' is the most well-studied robot and has the most empirical evidence of being therapeutic for older people with dementia.

<sup>37</sup> Astaras, Alexander & Lewy, Hadas & James, Christopher & Katasonov, Artem & Ruschin, Detlef & Bamidis, Panagiotis. (2015). Unobtrusive smart environments for independent living and the role of mixed methods in elderly healthcare delivery: The USEFIL approach

<sup>38</sup> Mayer P, Güldenpfennig F, Panek P. Towards Smart Adaptive Care Toilets. *Stud Health Technol Inform.* 2019;260:9-16. PMID: 31118313

<sup>39</sup> <https://techhousing.co.uk/fit-homes/> Accessed 10.11.2020

<sup>40</sup> Bissoli A, Lavino-Junior D, Sime M, Encarnação L, Bastos-Filho T. A Human-Machine Interface Based on Eye Tracking for Controlling and Monitoring a Smart Home Using the Internet of Things. *Sensors (Basel).* 2019;19(4):859. Published 2019 Feb 19. doi:10.3390/s19040859

<sup>41</sup> Liu L, Stroulia E, Nikolaidis I, Miguel-Cruz A, Rios Rincon A. Smart homes and home health monitoring technologies for older adults: A systematic review. *Int J Med Inform.* 2016 Jul;91:44-59. doi: 10.1016/j.ijmedinf.2016.04.007. Epub 2016 Apr 19.

<sup>42</sup> Góngora Alonso S, Hamrioui S, de la Torre Díez I, Motta Cruz E, López-Coronado M, Franco M. Social Robots for People with Aging and Dementia: A Systematic Review of Literature. *Telemed J E Health.* 2019 Jul;25(7):533-540. doi: 10.1089/tmj.2018.0051. Epub 2018 Aug 23.

<sup>43</sup> Bemelmans R, Gelderblom GJ, Jonker P, de Witte L. Effectiveness of Robot Paro in Intramural Psychogeriatric Care: A Multicenter Quasi-Experimental Study. *J Am Med Dir Assoc.* 2015 Nov 1;16(11):946-50. doi: 10.1016/j.jamda.2015.05.007. Epub 2015 Jun 23.

<sup>44</sup> Lihui Pu, MSN, Wendy Moyle, PhD, Cindy Jones, PhD, Michael Todorovic, PhD, The Effectiveness of Social Robots for Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Studies, *The Gerontologist*, Volume 59, Issue 1, February 2019, Pages e37–e51,

<sup>45</sup> Bemelmans R, Gelderblom GJ, Jonker P, de Witte L. Effectiveness of Robot Paro in Intramural Psychogeriatric Care: A Multicenter Quasi-Experimental Study. *J Am Med Dir Assoc.* 2015 Nov 1;16(11):946-50. doi: 10.1016/j.jamda.2015.05.007. Epub 2015 Jun 23. PMID: 26115817.

<sup>46</sup> Moyle W, Jones C, Murfield J, Thalib L, Beattie E, Shum D, Draper B. Using a therapeutic companion robot for dementia symptoms in long-term care: reflections from a cluster-RCT. *Aging Ment Health.* 2019 Mar;23(3):329-336. doi: 10.1080/13607863.2017.1421617. Epub 2017 Dec 28. PMID: 29282989.

<sup>47</sup> Jøranson N, Pedersen I, Rokstad AM, Ihlebæk C. Effects on Symptoms of Agitation and Depression in Persons With Dementia Participating in Robot-Assisted Activity: A Cluster-Randomized Controlled Trial. *J Am Med Dir Assoc.* 2015 Oct 1;16(10):867-73. doi: 10.1016/j.jamda.2015.05.002. Epub 2015 Jun 18. PMID: 26096582.

A systematic review also considered enablers and barriers to implementation of robotic technology.<sup>48</sup> Enablers include enjoyability, intuitiveness and ease of use. Barriers included technical issues and limited performance (e.g. problems with understanding the robot's speech). An evaluation study confirmed that a need to improve ICT and Wifi access within residential homes to improve use of robotics.<sup>49</sup> Generally there is a need to ensure adequate training for staff.<sup>50 51</sup> Research gives less consideration to the needs of the workforce<sup>52</sup> and inclusive design and implementation involving users and professionals involved in their care.<sup>53</sup>

Where service processes were considered in these studies they uncovered practical issues. For example PARO needs to be regularly cleaned, stored correctly and batteries charged, which can be an additional burden on professionals.<sup>54</sup>

Many of the robotic studies are still at prototype stage, e.g. in lab-setting, tested on small sample sizes.<sup>55 56</sup> There is little evidence of 'real world' use outside of research settings. An anecdotal case study reports on the use of the robot '[Pepper](#)' in South-End-Sea to support reminiscence sessions in care homes, but there is no supporting data.<sup>57</sup>

One issue is cost - it is estimated that the use of robotics could result in social care

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<sup>48</sup> Papadopoulos I, Koulouglioti C, Lazzarino R, et al. Enablers and barriers to the implementation of socially assistive humanoid robots in health and social care: a systematic review. *BMJ Open* 2020;10:e033096.

<sup>49</sup> Huisman C, Kort H. Two-Year Use of Care Robot Zora in Dutch Nursing Homes: An Evaluation Study. *Healthcare (Basel)*. 2019;7(1):31. Published 2019 Feb 19. doi:10.3390/healthcare7010031

<sup>50</sup> Huisman C, Kort H. Two-Year Use of Care Robot Zora in Dutch Nursing Homes: An Evaluation Study. *Healthcare (Basel)*. 2019;7(1):31. Published 2019 Feb 19. doi:10.3390/healthcare7010031

<sup>51</sup> Papadopoulos I, Koulouglioti C, Lazzarino R, et al. Enablers and barriers to the implementation of socially assistive humanoid robots in health and social care: a systematic review. *BMJ Open* 2020;10:e033096.

<sup>52</sup> Papadopoulos I, Koulouglioti C, Lazzarino R, et al. Enablers and barriers to the implementation of socially assistive humanoid robots in health and social care: a systematic review. *BMJ Open* 2020;10:e033096.

<sup>53</sup> Góngora Alonso S, Hamrioui S, de la Torre Díez I, Motta Cruz E, López-Coronado M, Franco M. Social Robots for People with Aging and Dementia: A Systematic Review of Literature. *Telemed J E Health*. 2019 Jul;25(7):533-540.

<sup>54</sup> Moyle W, Jones C, Murfield J, Thalib L, Beattie E, Shum D, Draper B. Using a therapeutic companion robot for dementia symptoms in long-term care: reflections from a cluster-RCT. *Aging Ment Health*. 2019 Mar;23(3):329-336.

<sup>55</sup> Cortellessa G, Fracasso F, Sorrentino A, Orlandini A, Bernardi G, Coraci L, De Benedictis R, Cesta A. ROBIN, a Telepresence Robot to Support Older Users Monitoring and Social Inclusion: Development and Evaluation. *Telemed J E Health*. 2018 Feb;24(2):145-154.

<sup>56</sup> Joan Saez-Pons, Dag Sverre Syrdal, and Kerstin Dautenhahn, "What has happened today? Memory visualisation of a robot companion to assist user's memory", *Journal of Assistive Technologies*, Vol. 9 (4): 207-218, 2015.

<sup>57</sup><https://www.govtechleaders.com/2017/08/15/council-looks-to-technology-enabled-care-to-transform-health-and-social-care-delivery/> Accessed 10.11.2020



savings,<sup>58</sup> but actual data is limited. No studies included here analyse cost or cost-savings. In fact in a qualitative study linked to a randomised control trial (RCT), nurses involved in using PARO were concerned that outside of the research study there would be no funds to introduce the robot into daily activities (the cost nearly £5,000 at the time of the study).<sup>59</sup>

## Sensors

Three studies consider the use of sensors to reduce risk of falls in older people, a walking speed sensor in people's homes,<sup>60</sup> a body-worn sensor ([Quantitative Timed Up and Go or QTUG](#)) used to predict falls risk and prescribe exercise during activity groups in Hampshire,<sup>61</sup> and home sensors to monitor activity in adults with dementia. The sensors are used on their own and not in a 'smart home environment'.<sup>62</sup> None of these studies involved control groups.

In terms of effectiveness, the walking speed study found that the sensors were able to capture movements effectively and that there was a positive response from older people, but no measures of outcomes in terms of fall risk reduction has been reported.<sup>63</sup>

While the QTUG study reports a reduced falls risk in 15 out of 19 care homes involved, there are no details on the measures used to ascertain this. Additionally, NICE concluded that key uncertainties exist around the ability of QTUG to assess frailty as there is a lack of evidence to support this function of the device.<sup>64</sup> As the device was used in the context of tailored exercise classes this may have influenced its effectiveness - the report states that the class tutors were able to spend more time focusing on the exercise classes and the residents doing them rather than carrying

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<sup>58</sup> Uk Parliament. Robotics in Social Care. Research report. December 2018: <https://post.parliament.uk/research-briefings/post-pn-0591/> Accessed 10.11.2020

<sup>59</sup> Wendy Moyle, Marguerite Bramble, Cindy Jones & Jenny Murfield (2018) Care staff perceptions of a social robot called Paro and a look-alike Plush Toy: a descriptive qualitative approach, *Aging & Mental Health*, 22:3, 330-335,

<sup>60</sup> Identifying and managing pre-frailty in older adults with a new walking speed sensor (WSS).[https://www.tsa-voice.org.uk/downloads/events\\_2019/itec\\_2019\\_breakout\\_session\\_slides/day\\_2\\_citizen\\_powered\\_proactive\\_services\\_-\\_presentation\\_3\\_-\\_joe\\_mcloughlin.pdf](https://www.tsa-voice.org.uk/downloads/events_2019/itec_2019_breakout_session_slides/day_2_citizen_powered_proactive_services_-_presentation_3_-_joe_mcloughlin.pdf)

<sup>61</sup> Using technology to reduce the risk of falls in Hertfordshir [https://www.local.gov.uk/sites/default/files/documents/1%2077%20Digital%20public%20health\\_02%201.pdf](https://www.local.gov.uk/sites/default/files/documents/1%2077%20Digital%20public%20health_02%201.pdf) Accessed 10.11.2020

<sup>62</sup> Gaugler JE, Zmora R, Mitchell LL, et al. Six-Month Effectiveness of Remote Activity Monitoring for Persons Living With Dementia and Their Family Caregivers: An Experimental Mixed Methods Study. *Gerontologist*. 2019;59(1):78-89. doi:10.1093/geront/gny078

<sup>63</sup> Identifying and managing pre-frailty in older adults with a new walking speed sensor (WSS).[https://www.tsa-voice.org.uk/downloads/events\\_2019/itec\\_2019\\_breakout\\_session\\_slides/day\\_2\\_citizen\\_powered\\_proactive\\_services\\_-\\_presentation\\_3\\_-\\_joe\\_mcloughlin.pdf](https://www.tsa-voice.org.uk/downloads/events_2019/itec_2019_breakout_session_slides/day_2_citizen_powered_proactive_services_-_presentation_3_-_joe_mcloughlin.pdf)

<sup>64</sup> QTUG for assessing falls risk and frailty. Medtech innovation briefing [MIB73] Published date: 26 July 2016. <https://www.nice.org.uk/advice/mib73> Accessed 10.11.2020



out a falls assessment. There was also an unexpected mental health benefit for residents. Their confidence and wellbeing levels, measured using self-reported scales, also increased with residents reporting feeling happier as a result of the classes and progress made. An exercise only control/crossover group would ascertain the true value of the device.

The remote activity monitoring (RAM) system for people with dementia did not have statistically significant effects on caregiving outcomes over a 6-month period.<sup>65</sup> However, caregivers who cared for relatives with: (a) less severe cognitive impairment; and (b) difficulty navigating around the home were more likely to indicate statistically significant increases in competence and self-efficacy, respectively.

There was limited information on technical and service processes in these studies, however the use of sensors normally requires careful placement and configuration<sup>66</sup>, the walking speed study states the sensors are 'easy to install'.<sup>67</sup> However, the RAM study found that the initial months spent calibrating and modifying the system to meet the particular needs of persons living with dementia and their family caregivers were potentially challenging to families.<sup>68</sup>

No descriptions of costs were included in any of these studies.

## Touchscreen tablets

7 studies explored touchscreen tablets and mobile phones, used in different ways to support older people, those with dementia and people with disabilities. In terms of effectiveness, this technology coupled with specific programs may help people with Alzheimer's complete tasks<sup>69</sup> and improve cognitive function and quality of life for

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<sup>65</sup> Gaugler JE, Zmora R, Mitchell LL, et al. Six-Month Effectiveness of Remote Activity Monitoring for Persons Living With Dementia and Their Family Caregivers: An Experimental Mixed Methods Study. *Gerontologist*. 2019;59(1):78-89. doi:10.1093/geront/gny078

<sup>66</sup> Thomas, B.L., Crandall, A.S. & Cook, D.J. A Genetic Algorithm approach to motion sensor placement in smart environments. *J Reliable Intell Environ* 2, 3-16 (2016).

<sup>67</sup> Identifying and managing pre-frailty in older adults with a new walking speed sensor (WSS).[https://www.tsa-voice.org.uk/downloads/events\\_2019/itec\\_2019\\_breakout\\_session\\_slides/day\\_2\\_citizen\\_powered\\_proactive\\_services\\_-\\_presentation\\_3\\_-\\_joe\\_mcloughlin.pdf](https://www.tsa-voice.org.uk/downloads/events_2019/itec_2019_breakout_session_slides/day_2_citizen_powered_proactive_services_-_presentation_3_-_joe_mcloughlin.pdf)

<sup>68</sup> Gaugler JE, Zmora R, Mitchell LL, et al. Six-Month Effectiveness of Remote Activity Monitoring for Persons Living With Dementia and Their Family Caregivers: An Experimental Mixed Methods Study. *Gerontologist*. 2019;59(1):78-89. doi:10.1093/geront/gny078

<sup>69</sup> Lancioni, G., Singh, N., O'Reilly, M., Sigafoos, J., D'Amico, F., Pinto, K., De Vanna, F. and Caffò, A. (2017), "A technology-aided program for helping persons with Alzheimer's disease perform daily activities", *Journal of Enabling Technologies*, Vol. 11 No. 3, pp. 85-91.

people with dementia.<sup>70</sup>

More generally, touchscreen tablets can be used in one-to-one, small groups and large groups to build rapport, increase engagement and help staff discover social care user's interests and capabilities, allowing for improved social connections and better communication with family members.<sup>71 72 73 74 75</sup> Access to personal tablets and mobile phones also improved confidence, independence and enhanced identity for people with disabilities.<sup>76</sup> A range of benefits were also seen for care homes and care staff, for example further opportunities for a person-centred approach and increased skills and confidence.<sup>77 78</sup>

While these studies were not randomised control trials, they provided detailed contextual information about the use of touchscreen tablets, that will be useful for those who also wanted to implement their use - particularly in care home settings. In terms of technical processes, the need for a stable Wifi connection could be an issue,<sup>79 80</sup> plus installation, maintenance and personalisation of specific hardware and

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<sup>70</sup> Astell, A.J., Smith, S.K., Potter, S. and Preston-Jones, E. (2018), Computer Interactive Reminiscence and Conversation Aid groups—Delivering cognitive stimulation with technology. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 4: 481-487.

<sup>71</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020. doi:10.1177/1471301220922745

<sup>72</sup> Darcy S, Green J, Maxwell H. I've got a mobile phone too! Hard and soft assistive technology customization and supportive call centres for people with disability. *Disabil Rehabil Assist Technol*. 2017 May;12(4):341-35

<sup>73</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

<sup>74</sup> Evans, S.C, Evans S, Bray, J. The iPad Project: Introducing iPads into care homes in the UK to support digital inclusion. April 2017 *Gerontechnology* 16(2):91-100

<sup>75</sup> Cleverclogs,' digitally enhanced care system - touch screen home hub  
<https://www.blackwoodgroup.org.uk/clevercogs> Accessed 11.11.2020

<sup>76</sup> Darcy S, Green J, Maxwell H. I've got a mobile phone too! Hard and soft assistive technology customization and supportive call centres for people with disability. *Disabil Rehabil Assist Technol*. 2017 May;12(4):341-351. doi: 10.3109/17483107.2016.1167260. Epub 2016 Jun 13. PMID: 27293107.

<sup>77</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

<sup>78</sup> Cleverclogs,' digitally enhanced care system - touch screen home hub  
<https://www.blackwoodgroup.org.uk/clevercogs> Accessed 11.11.2020

<sup>79</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020. doi:10.1177/1471301220922745

<sup>80</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

software was often needed.<sup>81 82 83 84</sup> Additional equipment can enhance the use of tablets such as the capacity to connect to a television in order to enlarge images.<sup>85</sup> Some apps can affect battery usage, particularly if the screen needs to be on or open all the time when a video is running.<sup>86</sup> Additional technical issues were associated with physical impairments such as button size and swipe action being difficult for people with poor motor skills.<sup>87</sup>

Services patterns and processes described involved the need for trained staff to run specific interventions<sup>88 89</sup> staff deployment to modify and customise the technology and providing ongoing support for users<sup>90</sup> or existing staff received additional training to incorporate touchscreen tablets into activities.<sup>91</sup> In general, having the technology present isn't enough - it's vital that training and support provided to staff to make the most of their potential to enhance quality of life.<sup>92</sup>

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<sup>81</sup> Lancioni, G., Singh, N., O'Reilly, M., Sigafoos, J., D'Amico, F., Pinto, K., De Vanna, F. and Caffò, A. (2017), "A technology-aided program for helping persons with Alzheimer's disease perform daily activities", *Journal of Enabling Technologies*, Vol. 11 No. 3, pp. 85-91.

<sup>82</sup> Astell, A.J., Smith, S.K., Potter, S. and Preston-Jones, E. (2018), Computer Interactive Reminiscence and Conversation Aid groups—Delivering cognitive stimulation with technology. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 4: 481-487.

<sup>83</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020.

<sup>84</sup> 'Clevercogs,' digitally enhanced care system - touch screen home hub  
<https://www.blackwoodgroup.org.uk/clevercogs> Accessed 11.11.2020

<sup>85</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

<sup>86</sup> Evans, S.C, Evans S, Bray, J. The iPad Project: Introducing iPads into care homes in the UK to support digital inclusion. April 2017 *Gerontechnology* 16(2):91-100

<sup>87</sup> Darcy S, Green J, Maxwell H. I've got a mobile phone too! Hard and soft assistive technology customization and supportive call centres for people with disability. *Disabil Rehabil Assist Technol*. 2017 May;12(4):341-351.

<sup>88</sup> Lancioni, G., Singh, N., O'Reilly, M., Sigafoos, J., D'Amico, F., Pinto, K., De Vanna, F. and Caffò, A. (2017), "A technology-aided program for helping persons with Alzheimer's disease perform daily activities", *Journal of Enabling Technologies*, Vol. 11 No. 3, pp. 85-91.

<sup>89</sup> Astell, A.J., Smith, S.K., Potter, S. and Preston-Jones, E. (2018), Computer Interactive Reminiscence and Conversation Aid groups—Delivering cognitive stimulation with technology. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 4: 481-487.

<sup>90</sup> Darcy S, Green J, Maxwell H. I've got a mobile phone too! Hard and soft assistive technology customization and supportive call centres for people with disability. *Disabil Rehabil Assist Technol*. 2017 May;12(4):341-351. doi: 10.3109/17483107.2016.1167260. Epub 2016 Jun 13. PMID: 27293107.

<sup>91</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

<sup>92</sup> How iPads can help people living with dementia: a summary A study by the University of Worcester, working with Anchor  
<https://anchorv3dev.s3.eu-west-2.amazonaws.com/documents-pdfs/within-media-section/How-iPads-can-support-people-with-dementia-living-in-care-homes-summary-report-2015.pdf> Accessed 11.11.2020

For touchscreen tablets to be used successfully in social care, there needs to be a 'system wide approach' to their implementation.<sup>93</sup> For example, a named person in a dedicated role needs to be in charge of the touchscreen tablets. The role would involve all aspects of storage, bookings, maintenance, including charging, updating and safety procedures.<sup>94 95</sup> More research is needed into how to adopt and adapt innovation into practice.<sup>96</sup>

There was no cost-saving or return on investment analysis conducted in these studies, but once the initial purchase has been made, a touch screen tablet or mobile phone may provide a relatively cheap digital technology option. However, there were worries about long term cost from users and staff, e.g. of being signed up to a mobile plan if it was an individual device<sup>97</sup> or suggestion that it would be more effective to opt for cheaper tablet models which would mean more could be purchased.<sup>98</sup>

## Other technology

7 other studies used a range of other digital assistive technology including video calls using a secure system and Skype, a smart flower stand, GPS technology, alarms, sensors and medication reminders and Amazon Echo. In the case of two studies the assistive technology used was not fully described and further follow-up is needed. In terms of methodological quality, one study was a crossover repeated measures study, but had a very small sample size due to difficulties in recruitment<sup>99</sup> one was a

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<sup>93</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020. doi:10.1177/1471301220922745

<sup>94</sup> Evans, S.C, Evans S, Bray, J. The iPad Project: Introducing iPads into care homes in the UK to support digital inclusion. April 2017 *Gerontechnology* 16(2):91-100

<sup>95</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020. doi:10.1177/1471301220922745

<sup>96</sup> Hung L, Chow B, Shadarevian J, et al. Using touchscreen tablets to support social connections and reduce responsive behaviours among people with dementia in care settings: A scoping review. *Dementia*. May 2020. doi:10.1177/1471301220922745

<sup>97</sup> Darcy S, Green J, Maxwell H. I've got a mobile phone too! Hard and soft assistive technology customization and supportive call centres for people with disability. *Disabil Rehabil Assist Technol*. 2017 May;12(4):341-351. doi: 10.3109/17483107.2016.1167260. Epub 2016 Jun 13.

<sup>98</sup> Evans, S.C, Evans S, Bray, J. The iPad Project: Introducing iPads into care homes in the UK to support digital inclusion. April 2017 *Gerontechnology* 16(2):91-100

<sup>99</sup> Van der Ploeg ES, Eppingstall B, O'Connor DW. Internet video chat (Skype) family conversations as a treatment of agitation in nursing home residents with dementia. *Int Psychogeriatr*. 2016 Apr;28(4):697-8. doi: 10.1017/S1041610215001854. Epub 2015 Nov 12. PMID: 26560943.

non randomised user experience study.<sup>100</sup> The rest were anecdotal case studies.<sup>101 102</sup>

Results of effectiveness were mixed. The use of Skype to communicate with family in a care home facility reduced agitation, but the reduction was not statistically significant.<sup>104</sup> Use of digital assistive technology devices **did not** significantly reduce burden for carers of people with memory problems.<sup>105</sup> There was a reported 15% decrease in the number of therapist visits needed as part of reablement service in Bath and Somerset using unspecified assistive technology. For some cases, therapists reported an improved sense of reassurance in their care package recommendations (15%).<sup>106</sup> There were examples of more personalised care and greater independence.

In terms of usefulness of the devices used, a GPS bracelet was useful for allowing older people with memory problems to go for independent walks.<sup>107</sup> Use of Amazon Echo had an impact on feelings of isolation, independence and connectedness for care users.<sup>108</sup> Also, in Hampshire 94 per cent of assistive technology users say care technology such as GPS tracking and alarms has “increased their feelings of safety and security” and 98 per cent would recommend the service to others.<sup>109</sup>

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<sup>100</sup> Nauha L, Keränen NS, Kangas M, Jämsä T, Reponen J. Assistive technologies at home for people with a memory disorder. *Dementia* (London). 2018 Oct;17(7):909-923. doi: 10.1177/1471301216674816. Epub 2016 Oct 20. PMID: 27765896; PMCID: PMC6168743.

<sup>101</sup> London Borough of Barnet

<https://www.local.gov.uk/sites/default/files/documents/25.115%20CHIP%20LIP%20WEB.pdf>

<sup>102</sup> Amazon Echo -- Hampshire County Council/Argenti

<https://www.paconsulting.com/our-experience/hampshire-county-council-helping-people-live-independently-for-longer-using-consumer-technology/>

<sup>103</sup> Hampshire County Council partnership with Argenti to provide assistive technology, 2018

<https://www.local.gov.uk/using-digital-technology-improve-publics-health-guide-local-authorities>

<sup>104</sup> Van der Ploeg ES, Eppingstall B, O'Connor DW. Internet video chat (Skype) family conversations as a treatment of agitation in nursing home residents with dementia. *Int Psychogeriatr*. 2016 Apr;28(4):697-8. doi: 10.1017/S1041610215001854. Epub 2015 Nov 12. PMID: 26560943

<sup>105</sup> Nauha L, Keränen NS, Kangas M, Jämsä T, Reponen J. Assistive technologies at home for people with a memory disorder. *Dementia* (London). 2018 Oct;17(7):909-923. doi: 10.1177/1471301216674816. Epub 2016 Oct 20. PMID: 27765896; PMCID: PMC6168743.

<sup>106</sup> Piloting a range of assistive technology and diagnostic apps and devices within their reablement and rehabilitation service in Bath

<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>107</sup> Nauha L, Keränen NS, Kangas M, Jämsä T, Reponen J. Assistive technologies at home for people with a memory disorder. *Dementia* (London). 2018 Oct;17(7):909-923. doi: 10.1177/1471301216674816. Epub 2016

<sup>108</sup> Amazon Echo -- Hampshire County Council/Argenti

<https://www.paconsulting.com/our-experience/hampshire-county-council-helping-people-live-independently-for-longer-using-consumer-technology/>

<sup>109</sup> Hampshire County Council partnership with Argenti to provide assistive technology, 2018

<https://www.local.gov.uk/using-digital-technology-improve-publics-health-guide-local-authorities>

There were technological and service process issues in some of these projects, for example the introduction of video communications for care in Essex, was found not to be not appropriate for short-term interventions. GDPR issues meant that they had to use a special secure system, which was not fit for purpose, a second system was used but it took professionals a considerable amount of time to become confident introducing and using the technology.<sup>110</sup>

Again, the technology used to assist reablement in Bath and Somerset had teething issues due to a lack of supplier testing before going live. The computer system used by the therapy staff was incapable of exploiting the technology to the full extent.<sup>111</sup>

The technological solutions deemed most useful by older people with memory problems were typically simple.<sup>112</sup> Devices and systems rated with poor usability, such as complex user interface and inadequate sound quality, were considered less useful. Problems were experienced particularly with the devices that used wireless networks and browser-based service management systems. Use of Amazon Echo requires an Amazon account and email, authors conclude that this service is 'not for all' and some users require extra support.<sup>113</sup>

Some issues with data collection, protection and analysis were reported. For example, many needed extra time to ensure compliance with data governance protocols and new GDPR regulations<sup>114 115 116</sup> Compliance with GDPR meant this pilot had to use specialist applications that met the requirements, but care professionals felt that using mainstream platforms such as Skype and Facetime would have been

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<sup>110</sup> Using video communication in care - Essex Country Council  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>111</sup> Piloting a range of assistive technology and diagnostic apps and devices within their reablement and rehabilitation service in Bath  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>112</sup> Nauha L, Keränen NS, Kangas M, Jämsä T, Reponen J. Assistive technologies at home for people with a memory disorder. *Dementia* (London). 2018 Oct;17(7):909-923. doi: 10.1177/1471301216674816. Epub 2016 Oct 20. PMID: 27765896; PMCID: PMC6168743.

<sup>113</sup> <https://www.local.gov.uk/sites/default/files/documents/W2.%20Assistive%20technology%20in%20supported%20living%20and%20community%20-%20Mark%20Allen.pdf>

<sup>114</sup> Piloting a range of assistive technology and diagnostic apps and devices within their reablement and rehabilitation service in Bath  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>115</sup> Amazon Echo -- Hampshire County Council/Argenti  
<https://www.paconsulting.com/our-experience/hampshire-county-council-helping-people-live-independently-for-longer-using-consumer-technology>

<sup>116</sup> Amazon Echo -- Hampshire County Council/Argenti  
<https://www.paconsulting.com/our-experience/hampshire-county-council-helping-people-live-independently-for-longer-using-consumer-technology>

easier to introduce due to confidence and familiarity.<sup>117</sup> Another challenge is dealing with large amounts of data that may be collected by devices e.g. from sensor, GPS systems - working out how to chunk up that data so it gives insight.<sup>118</sup>

Use of Amazon Echo in Hampshire meant that two service users' care packages were reduced with a total value of £5,000 per annum. However overall care costs were not reduced.<sup>119</sup> Generally, Hampshire County Council in partnership with Argenti report delivering more than £13 million in net savings for the Council by helping to avoid, reduce or delay costlier forms of care using assistive technology.<sup>120</sup>

In Barnet, the installation of care technology did not result in a saving in every case. However, identified cost savings of up to £20,000 were achieved through reductions in overnight care in particular.<sup>121</sup> In Bath and North Somerset total cost avoided over 52-week period: £4,563.86 (larger sample size may bring more savings)<sup>122</sup> In Essex, financial modelling indicated that the cost of a visit could be reduced by 40% if undertaken via a video call rather than physical visit. However, in practice none of the visits were replaced with a video call so no savings can be attributed to this project.<sup>123</sup>

## Summary and conclusions

- The systematic reviews and randomised control trials included in this review provide some good research evidence on the effectiveness of technology - particularly for smart home technology and socially assistive robotics; and in some cases user experience and barriers/enablers to implementation.

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<sup>117</sup> Using video communication in care - Essex Country Council  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>118</sup> Hampshire County Council partnership with Argenti to provide assistive technology, 2018  
<https://www.local.gov.uk/using-digital-technology-improve-publics-health-guide-local-authorities>

<sup>119</sup> <https://www.local.gov.uk/sites/default/files/documents/W2.%20Assistive%20technology%20in%20supported%20living%20and%20community%20-%20Mark%20Allen.pdf>

<sup>120</sup> Hampshire County Council partnership with Argenti to provide assistive technology, 2018  
<https://www.local.gov.uk/using-digital-technology-improve-publics-health-guide-local-authorities>

<sup>121</sup> London Borough of Barnet  
<https://www.local.gov.uk/sites/default/files/documents/25.115%20CHIP%20LIP%20WEB.pdf>

<sup>122</sup> Piloting a range of assistive technology and diagnostic apps and devices within their reablement and rehabilitation service in Bath  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>

<sup>123</sup> Using video communication in care - Essex Country Council  
<https://www.local.gov.uk/sites/default/files/documents/Essex%20County%20Council%20LIP%20Case%20Study.pdf>



- Other types of studies provide some contextual information about 'real world' use. However there tends to be a lot of basic information missing - particularly where anecdotal case studies don't report sample sizes or outcome measurement. Many case studies rely only on measuring what users think about the assistive technology, but do not collect or report on data that may measure the actual impact of the digital assistive technology.
- Service processes have been described in some studies - including more rigorous research and anecdotal case studies. Processes are particularly well described in studies about implementing touchscreen devices. The general message is that technology alone is not enough, it needs to be implemented alongside adequate staff training, resources and buy-in, a 'system-wide approach.' Suggestions about having specific members of staff to take ownership/leadership of the technology and implement specific procedures for charging, maintenance and storage could be useful for all types of digital assistive technology. It's important that it fits in with the workforces' existing demands in order for it to work effectively, for example one study of smart technology found that the nurses involved did not have adequate access to devices to check on alerts received.
- There is very little evidence about cost and return on investment in any of the research found. Except by studies included in the 'other technology section' - many of these received investment from the Local Government Association and provide detail on cost-savings and return on investment as part of their reporting.
- Much of the digital assistive technology described is high cost - for example using multiple sensors and robotics, this may result in slow technology adoption. However, there are examples of low-cost off the shelf technology being used, some of this work is still ongoing.
- Much of the technology is in prototype or pilot stage and not well-used out of research studies. There is less evidence of 'real world' benefit and where it exists, it is poorly described. Some technology has already been adopted without much rigorous research evidence.
- Many studies list problems with technology, such as technological failure and connectivity issues such as inadequate Wifi, and or difficulties with battery and recharging opportunities. Lengthy installation and configuration processes can be off-putting for staff and users. This needs to be accounted for in any future research or service delivery.
- Simple technology is often preferred. Better involvement of users and staff may result in greater technology adoption as what is delivered will greater meet their needs.
- Very few research studies consider data processing issues. Difficulties with data processing are described in Local Government Association reports and

additional time being required in order to ensure data compliance.

## Methodology

The following resources were searched:

- Cochrane Database of Systematic Reviews (CDSR)
- MEDLINE PubMed.gov ([pubmed.ncbi.nlm.nih.gov/](http://pubmed.ncbi.nlm.nih.gov/))
- Social Care Online <https://www.scie-socialcareonline.org.uk/>

To look for 'grey literature' GoogleScholar and a number of relevant websites were also searched (see Appendix 1). The primary search strategy was designed using the MEDLINE PubMed platform, using a combination of keywords and MeSH terms, and then adapted for use in the additional databases and websites. Searching was iterative as new sources were discovered by hand searching papers and reports during the process.

Titles and abstracts were screened for relevance, duplicates removed and papers were excluded if they did not meet the inclusion criteria, 56 papers were read in full and a final 39 studies were included in this review.

Due to the broad and exploratory nature of this review, no papers were excluded because of their methodological quality or missing data, but instead considered in terms of whether they met the inclusion criteria.

They are listed in full in spreadsheet [tbc]

### Inclusion criteria

- English Language studies.
- Published between 2015-2020.
- Primary context social care rather than solely medical settings/measurement.
- Study, report or some description of the impact of the DAT on social care related outcomes e.g. social isolation, quality of life, well-being, access to services, independence or other measures.
- Reviews are included where they summarise the benefits, outcomes or effectiveness of specific DAT products.

## Appendix 1: Search Strategy

Key/MeSH terms used:

PubMed ((assistive technology) OR (assistive device)) AND (social care)

GoogleSearch ("digital assistive technology") ("social care") 2015..2020

(((((("Self-Help Devices"[Mesh:NoExp]) OR "Communication Aids for Disabled"[Mesh:NoExp]) OR "Computers, Handheld"[Mesh]) OR "Cell Phone"[Mesh]) OR "Mobile Applications"[Mesh:NoExp]) OR (technological aid\*[ti] OR email\*[ti] OR e-mail\*[ti] OR "electronic mail\*" [ti] OR text-message\*[ti] OR SMS[ti] OR MMS[ti] OR WhatsApp[ti] OR Telegram[ti] OR Alexa[ti] OR instant message\*[ti] OR personal digital assistant\*[ti] OR PDA[ti] OR smartphone\*[ti] OR smart phone\*[ti] OR cellphone\*[ti] OR cell-phone\*[ti] OR iPhone[ti] OR iPad[ti])) OR (internet of things[Title/Abstract])) OR ((personal\*[ti] OR smart\*[ti] OR mobile[ti] OR android[ti] OR internet[ti] OR web[ti] OR wearable[ti]) AND (comput\*[ti] OR device[ti] OR appl\*[ti] OR apps[ti] OR phone[ti] OR watch\*[ti] OR alarm[ti] OR tracker\*[ti] or monitor\*[ti])) OR ((assistive[Title] OR smart[Title]) AND (technolog\*[Title]))) AND (((("Social Support"[Mesh:NoExp]) OR "Home Care Services"[Mesh:NoExp]) OR "Health Services Accessibility"[Mesh:NoExp]) OR "Disabled Persons"[Mesh]) OR ((social[Title] AND (care[Title] OR service\*[Title] OR work[Title] OR support\*[Title])) OR (integrated care[Title]))

[limited to last 5 years]

<b>Databases/websites/other sources</b>	<b>Hits</b>	<b>Limits applied</b>	<b>Full text papers reviewed</b>
PubMed <a href="http://www.ncbi.nlm.nih.gov/pubmed/">http://www.ncbi.nlm.nih.gov/pubmed/</a>	3,252 results	958 results	8
Cochrane Database of Systematic Reviews	78	38	1
Social Care Online <a href="https://www.scie-socialcareonline.org.uk/">https://www.scie-socialcareonline.org.uk/</a>	1344	443	29
GoogleScholar	4,180	2,500	2
Local Government Association <a href="https://www.local.gov.uk/">https://www.local.gov.uk/</a>	384	n/a	5
Global Disability Innovation (GDI) Hub <a href="https://www.disabilityinnovation.com/">https://www.disabilityinnovation.com/</a>	102	n/a	2
National Care Forum <a href="https://www.nationalcareforum.org.uk/">https://www.nationalcareforum.org.uk/</a>	6	n/a	6

Digital Social Care <a href="https://www.digitalsocialcare.co.uk/">https://www.digitalsocialcare.co.uk/</a>	3	n/a	3
Go.uk websites (local government) "assistive technology" site:gov.uk -site:comanieshouse.gov.uk 2015-2020	147,000 results	Last 5 years - 1,490 results	0