RESEARCH ARTICLE

DIALOGUE: Digital care technologies for social connection, care and support of older adults. Final Project Report.

[version 1; peer review: awaiting peer review]

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v1 **First published:** 09 Oct 2025, **5**:95
https://doi.org/10.3310/nihropenres.13994.1
Latest published: 09 Oct 2025, **5**:95
https://doi.org/10.3310/nihropenres.13994.1

Abstract

Introduction

Despite significant social and financial investment, evidence suggests that technology-enabled care services (TECS) for older adults with assisted living needs fail to meet their potential. Simultaneously, an increasingly diverse range of care and consumer technologies are entering the market with the potential to deliver innovative, effective, cost-effective, and scalable social care services. However, there is limited evidence illustrating how novel digital technologies are currently being deployed across social care. Before high-quality evidence can be generated, we need a clearer sense of delivery, what outcomes are being achieved, and the factors influencing their implementation and adoption at scale.

Methods

Open Peer Review

Approval Status *AWAITING PEER REVIEW*

Any reports and responses or comments on the article can be found at the end of the article.

DIALOGUE identifies the novel digital care technologies being implemented for social care services for community-dwelling older adults with assisted living needs that have the greatest potential for future social care research. Working with two local authorities and an Integrated Care Board, DIALOGUE adopted a mixed methods approach, including a rapid review of academic and professional literature regarding technology implementation in social care, three co-production partnerships with older people with assisted living needs using digital technologies in social care services, a process evaluation of social care TEC delivery, and an e-Delphi survey of TECS staff.

Results

Older adults using social care services identified priorities in relation to signposting and information seeking, safety, security and trust, and costs and financing technologies as key priorities. Local authorities highlighted building awareness and training in person-centred approaches to TECS, building the evidence base for TECS, and ensuring that commissioning and implementation of TECS is aligned with service user priorities.

Conclusion

Project findings are being used to build a programme for future research regarding effective person-centred implementation of Social Care TECS. Initial work in building this agenda includes applications for NIHR research Health Technology Assessment and Research Programme for Social Care funding during 2024–2025.

Plain Language Summary

Social care services use new technologies such as mobile phones, tablets, apps, smart speakers, artificial intelligence, and social robots. These technologies might be easier for people to use while also being cheaper to provide. However, we do not know what new technologies are being tried by services, how services might need to change to use these technologies, or whether they are better than what is usually provided.

DIALOGUE asked what was important for people to use and provide social care services. For clients, providing information about available technologies, how to access them, and making sure they are easy to access. For services, ensuring that staff are trained in technologies, having better evidence about whether technologies help older people, and how to use technologies in ways that meet the needs and preferences of individual older people is important. These results will help us write applications for future research funding.

Keywords
Social care, technology-enabled care services, hospital discharge, digital, older adults

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Competing interests: No competing interests were disclosed.

Grant information: This project is funded by the National Institute for Health Research (NIHR) under its HTA Application Accelerator Award (NIHR160125). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

How to cite this article: Gibson G, Lariviere M, Steils N *et al.* **DIALOGUE: Digital care technologies for social connection, care and support of older adults. Final Project Report. [version 1; peer review: awaiting peer review]** NIHR Open Research 2025, **5**:95 https://doi.org/10.3310/nihropenres.13994.1

First published: 09 Oct 2025, **5**:95 https://doi.org/10.3310/nihropenres.13994.1

Introduction

The demands of an aging population and a commensurate increase in poor health and multiple morbidities mean that the ongoing provision of social care services to older people with assisted living needs is a key challenge facing the UK. Social care services (SCS) have long identified digital care technologies as a means of supporting the growing number of older people with such needs. Local Authorities (LAs) continue to invest in Technology Enabled Care Services (TECS) to enable older people to 'age in place.' With the provision of ongoing domiciliary care packages, including the deployment of assistive technologies, people can remain at home longer by receiving faster discharge from the hospital or delaying entry into residential care services. TECS routinely deploy first generation pendant alarms, which have been an established part of care systems for decades. recently, second generation 'telecare' remote monitoring services, which can collect and aggregate a wealth of sensor data to provide smart monitoring of a person's activities and health states, have become a core element. Technological change in the sector continues to gather pace, and social care services are currently exploring the potential of integrating an increasingly diverse range of digital, 'smart' care and consumer technologies (third generation) with the potential to truly transform digital care services. Such technologies include novel 'off the shelf' consumer products, such as mobile Global Positioning Systems (GPS), equipped monitoring alarms, smart speakers, smart phones, tablets, and apps. Wider near-future innovations, such as artificial intelligence and machine learning platforms, social robots, and chatbots, are also increasingly seen as potential options for deployment in TECS as an embryonic fourth generation of technology in care (Hamblin & Lariviere, 2023).

When combined, these four generations of technology have the potential to transform TECS provisions for older adults. However, our best evidence to date regarding social care TECS indicates that traditional TECS do not achieve their therapeutic goals and are not cost-effective (Gathercole *et al.*, 2021; Gaugler *et al.*, 2021; Henderson *et al.*, 2014; Howard *et al.*, 2021; Steventon *et al.*, 2013; Woolham *et al.*, 2018; Wright, 2020). While TEC services remain largely based on 2nd generation telecare platforms, recent research shows that services are starting to embrace the potential of embedding a more diverse range of digital care technologies based on predominant policy discourses that continue to state that such innovations will inevitably bring about improvements in services (Hamblin & Lariviere, 2023; Whitfield & Hamblin, 2025; Wright & Hamblin, 2023). If delivered successfully, these novel technologies possess the potential to deliver innovative, effective, cost-effective, and scalable person-centred services that are better suited to an individual's needs. However, evidence from past research on technology adoption suggests that the benefits of technology innovations in care are not inevitable, and any improvements experienced are likely to depend on the technological, policy, and service delivery contexts in which technologies are delivered alongside the local requirements of need (Greenhalgh *et al.*, 2017).

The highly fragmented nature of adult social care, involving numerous public, private and third sector actors means significant barriers stand in the way of achieving this vision across digital care services (Freeman *et al.*, 2022). The implementation of digital innovations in social care can be characterized by 'pilotitis;' a preponderance of pilot evaluations conducted by individual LAs which are only rarely shared across the sector and are not routinely delivered at scale (Whitfield & Hamblin, 2022; Woolham *et al.*, 2018). Additionally, LAs frequently lack technical capacity, capability, and resources to assess the effectiveness of these technologies (Wright, 2020). Finally, local authorities may use different configurations of technologies and services based on local client needs, budgetary constraints, commissioning requirements, or relationships with technology suppliers. Combined with the high number of small-scale pilots and lack of larger-scale evaluations, such disparities may lead to 'postcode lotteries' where technologies become unequally distributed, further exacerbating digital, social, and age-based inequalities (Whitfield & Hamblin, 2022). In sum, there is limited evidence to illustrate exactly what novel digital technologies are being deployed across social care, what their delivery looks like in practice, what their key outcomes are, whether they are achieving them, the factors influencing their implementation in services and adoption by service users, and what might help or hinder their delivery at scale.

The aim of the DIALOGUE project is to begin the process of mapping out a future research agenda regarding the development and implementation of personalized, person-centred TECS within social care. Using a range of research methods, including co-production with older users of social care services, DIALOGUE sought to identify research priorities in relation to novel TECS within social care to develop a future research agenda for the incorporation of novel technologies within social care-based TECS. This agenda includes research applications to major funders to grow the evidence base regarding current and future provision of technologies within social care services, priority areas where such technologies are being or should be deployed, and the local factors that will influence commissioning, delivery, implementation, and adoption of novel technologies and services within social care settings.

Aims and objectives

The original aim of the DIALOGUE project was to generate timely and appropriate data about current TECS provisions to co-produce an application to the NIHR HTA Social Care Technologies Call 2024, which will select and evaluate novel digital care technologies with the potential to form an effective, sustainable part of social care for older adults with assisted living needs living in the community. To fulfil these aims, DIALOGUE has the following objectives.

O1. Identify novel digital care technologies for community-dwelling older adults with assisted living needs that have the greatest potential for inclusion in full application.

O2. Synthesize current evidence for novel digital care technologies and, using this evidence, co-produce a set of outcome measures appropriate for social care research.

O3. Co-create with older people using digital care services and social care providers an embedded, mixed-methods evaluation methodology, comprising an outcome realization toolkit and an economic assessment appropriate to social care interventions and other primary outcome measures, which can be used to assess the effectiveness of the identified novel digital care technologies in social care.

O4. Co-produce a high-quality, fundable application for the NIHR HTA Social Care Technologies Assessment Call 2024.

Project methodology and methods

Methods

Employing co-production activities and working to bring together academic experts, local authority stakeholders, and older people with lived experience of using social care as equal partners, DIALOGUE worked to identify priorities for future research and delivery of TECS within social care. The project worked in two local authorities, Middlesbrough and Oxfordshire councils, and one Integrated Care Board (ICB): Bristol, North Somerset, and South Gloucestershire (BNSSG) ICB, to bring together stakeholders with an interest in the delivery and implementation of TECS for older people with assisted living needs. Further details of the local authority/ICB partners and their associated TECS services are provided below. TECS, which provided the focus for this project and informed project outcomes, were Post Hospital Discharge and Reablement Services (PHDRS). It became clear that PHDRS were a major priority for service delivery and ongoing service development, and these services quickly became a focus for the project and its associated activities. While having the same overall goal, the projects used a diverse range of technologies, delivered via different service configurations and goals, and involved different stakeholders and partners in their delivery, including the private sector.

Middlesbrough Council Hospital to Home service operates a "Discharge to Assess, Home First" approach, which emphasizes discharging patients to home as soon as they are clinically ready. Hospital Prevention liaison officers located in hospital teams facilitate discharge, while community prevention liaison officers provide post-discharge support. Technology is provided via holistic needs assessment, referring clients to prevention and reablement services, including telecare services. Service users were reviewed at 12 weeks and six months. The deployed technologies include" Just Checking' monitoring systems, GPS trackers, and fall detectors. Plans include integrated smart care solutions using household smart devices (e.g., Amazon Alexa speakers).

Innovate Oxfordshire (Oxfordshire County Council) Home First service is a 'discharge to assess service' where clients are initially assessed by a Home First Multi-disciplinary team, before receiving reablement services provided by four private strategic providers. The service is provided within 72 hours of hospital discharge and then installed for six weeks before referral to long-term care if needed. Services have a range of options for assistive technology, including telecare systems, sensors, and monitoring technologies.

Bristol, North Somerset, and South Gloucestershire Integrated Care Board. BNSSG ICB supports a regionally integrated system in three LAs (North Somerset Council, South Gloucestershire Council, Bristol City Council), alongside seven NHS Trusts and a private care provider (Sirona Health and Care; henceforth Sirona). The ICB is piloting a service delivered by Sirona to centralize support for more rapid discharge from the hospital before people can be supported by LA assessments. The services provided include a monitored alarm service and assistive technologies to support the risk of falls, wandering, inactivity, medication compliance, activities of daily living, and sensory and memory impairments. The pilot project plans to expand and offer an integrated care system using smart household technologies.

Over the course of the project, we engaged with the following stakeholders:

- Three co-production groups each comprising five to eight older people with diverse experiences of using social care services in the North East, South West, and Central and Eastern areas of England. Each group met with four co-production workshops held between April and October 2024.
- Staff members involved in the commissioning and delivery of TECS in the participating local authorities/ICBs participated in a combination of semi-structured interviews, two e-Delphi surveys, and a consensus workshop.
- Academic experts in TECS were invited to participate in a consensus workshop to discuss priorities for economic and cost-effectiveness evaluations within the TECS.

The DIALOGUE project included five empirical work packages that sought to summarize existing evidence and collect further evidence regarding TECS delivery to identify future priorities for a social care TECS research agenda. These work packages were organized to support the identification of priorities for future research from the perspectives of different stakeholders and forms of evidence in the field.

1. WP1. Three co-production partnerships with older people with assisted living needs and experiences using social care services.
2. WP2. Evidence synthesis via a rapid literature review of the current evidence for TECS delivered within social care.
3. WP3. Process evaluation exploring one example of TECS delivered in social care: Post Hospital Discharge and Reablement Services (PHDRS) delivered within each of the fieldwork sites. Fieldwork in the process evaluation included semi-structured interviews with representatives in local authorities, and analysis of secondary data categories collected within local authority services,

to identify data categories routinely collected within services and identify what opportunities for further statistical analysis are feasible using this data.

4. WP4. An e-Delphi survey and subsequent consensus workshops with social care practitioners at the three fieldwork sites sought to identify core priorities for service development and core outcomes for service delivery.

5. WP5. A fifth work package sought to bring together findings from the project and identify outputs emerging from the project, including applications to NIHR programs (HTA and, additionally, RPSC).

The remainder of this paper reports the methodology and findings of each work package and its related research activities.

Ethical approvals and data sharing agreements

Ethical approval for DIALOGUE was obtained from the lead institution of the University of Stirling via two separate ethics review applications [GUEP 2024 18182 13299; GUEP 2024 18627 13566].The first ethical approval [GUEP 2024 18182 13299] covered the WP1 workshop methodology, recruitment and consent of WP1 participants including. Subsequent ethical approval was sought for activities in WP2-WP5 [GUEP 2024 18627 13566] and included consent procedures (Consent forms/information sheets) topic guides and research methodologies covering WP3 professional interviews, WP4 e-Delphi exercise and consensus workshops). Once completed, all paper-based approval forms were collected and stored centrally by the principal investigator at the host institution. Data-sharing agreements were also set up at the beginning of the project to enable the sharing of secondary data between local authorities and the project team. During ethics application processes agreement was made not to share raw qualitative and quantitative data in data repositories because of the potential for participants in the research to be identified. Research activities adhered to requirements as set out in the Declaration of Helsinki.

Informed consent

Informed consent to participate in research activities was recorded at the beginning of research activities in individual work packages, via written or e-signatures provided at the beginning of research activities (e.g. co-production workshops) or during organisation of qualitative interviews and workshops with social care service professionals. In addition to written consent provided digitally or in person, verbal consent was also given by social care professionals at the beginning of individual qualitative interviews or at the beginning of group workshops.

Work package 1 – Co-production partnerships

WP1 provides an overview of co-production workshops conducted across three sites located in England: Middlesbrough, Bristol, and Central England. For each workshop (x4) per site, participants were presented with a series of scenarios, whereby the character and various technologies were described in various settings. This approach enabled the workshop participants to consider solutions and discuss potential challenges and concerns. Future considerations for expanding this work include more diverse voices from broader ethnic communities, including people who are digitally illiterate and/or who have limited digital literacy skills.

Methods

Patient and public involvement in the proposal and the research project

The primary goal of the project was to work in partnership with older people using social care services to identify their experiences of using social care services. We then used these experiences to identify priorities for development of future research regarding adoption and implementation of technologies within social care services. Hence social care service users were integral to the initial design of the research funding application, delivery of the research project, and generating the principal findings reported in this paper.

Involvement in proposal development

During the proposal writing phase and application for funding, we built relationships with three organisations supporting older people using social care services. In South West England we worked with Age UK Bristol. In Central England we worked with an existing service user lived experience advisory panel working on existing social care research projects organised by one of the project co-investigators (JL) at the University of Hertfordshire and the charity 'Shaping Our Lives'. In North East England we worked with Rekindle, who support co-produced research projects in social care in conjunction with Middlesbrough council. Ten people across the three organisations provided feedback on the proposal design in a combination of email exchanges and an online development workshop. During this process RM, an older person with lived experience of social care services was also invited to join the project team as a Co-Investigator, acting as PPI lead with support from the project team. During the proposal writing stage the participating older people were provided with early drafts of the project outline and proposed co-production activities and were given the opportunity to contribute their perspectives on planned project activities via video call or via written feedback. Feedback was provided regarding the plan and order of specific project work packages, the overall scope of the project, identifying target groups of older people with lived experience of social care who are likely to be priorities for the project, including likely technologies that will be targeted within the project. Specific technologies listed as potential targets included consumer smart technologies which may be deployed by social care, and technologies that promote social connectedness. The older people provided specific feedback on the initial project design, including appropriate design of co-production activities in WP1, the type, scope, and questions in the literature review in WP2, the scope and role of the WP3 process evaluation and choice of e-Delphi survey and associated consensus workshops in WP4. These elements were then fed into subsequent iterations of the project plan. Detailed feedback was also provided to ensure the plain English summary centred the perspectives of those older people with lived experience.

Involvement in project delivery

Service user involvement was built around the creation of three co-production partnerships, in which older people using social care services worked with the project team to identify key priorities for future technology research which can inform future research questions and future applications for research projects. Three project partner organisations (Age UK Bristol, Rekindle and Shaping our Lives) supported the research team to identify a diverse sample of 18 older people who were in receipt of social care services were recruited to take part in a series of three co-production partnerships in the three study areas. Further details of the sample of older people who took part in the project are detailed in Table 1. The original ten people invited to contribute to the proposal were also invited as part of the 18 people who joined the workshops. The PPI lead (RM) worked with the WP1 work package lead (HRM) to design co-production workshops, and to provide resources to support the organisation of these workshops. The co production workshops engaged in analysing data in all project work packages. Initial co-production workshops generated information regarding priorities for technology deployment and for ongoing and future service development, experiences of using social care technologies and the identification of outcomes for the evaluation for such technologies and services, such client wellbeing and quality of life. During later co-production workshops, the older people using services were provided with interim results from activities in WP2, WP3 and WP4, and given the opportunity to contribute to analysis of WP3 and WP4 data. Co production workshop members also contributed to checking of project data, and plans for dissemination of results through their own personal networks, and through the host organisations listed above. The final co production workshop concerned the generation of dissemination of the research via executive summaries, presentations, and targeted conference presentations.

Table 1. Participant characteristics. Table provide location, age and sex details for participants who took part in co production workshops delivered as part of WP1. Workshops took place in two localities (Bristol, Middlesbrough) and online in the case of participants in co-production workshops delivered in Hertfordshire.

Site	Partner name/ID	Age	Sex
Middlesborough	M1	>80	Woman
Middlesborough	M2	>70	Woman
Middlesborough	M3	>60	Woman
Middlesborough	M4	>70	Woman
Middlesborough	M5	>70	Man
Hertfordshire	H1	>60	Woman
Hertfordshire	H2	>60	Woman
Hertfordshire	H3	>60	Woman
Hertfordshire	H4	>60	Man
Hertfordshire	H5	>60	Man
Bristol	B1	>70	Woman
Bristol	B2	>70	Man
Bristol	B3	>70	Woman
Bristol	B4	>70	Woman
Bristol	B5	>70	Woman
Bristol	B6	>70	Woman
Bristol	B7	>70	Man
Bristol	B8	>70	Woman

The co production workshops, alongside wider project activities across all project work packages identified the priority of supporting early discharge from, and reducing re-admissions into hospital via technology enabled care services delivered in social care as a core focus for subsequent project development. This focus was further developed in a project application to NIHR's Research Programme for Social Care, for research funding to evaluate outcomes and factors influencing deployment and implementation of technology enabled post hospital discharge and reablement services delivered within social care. At the time of publication this funding was awarded, with the project due to start in Spring 2026. An earlier application to NIHR's HTA programme was made in early 2024 to conduct a randomised controlled trial of social care delivered post hospital discharge services, which did not progress past stage one. Participants in the co-production workshops supported identifying these priorities and provided advice and feedback on the development of both project applications through initial focused discussion of priorities in earlier workshops, and by giving feedback on proposed research designs, on early application drafts.

Research methodology

Co-production was employed in WP1, together with older people using social care, to understand the challenges, concerns, and enablers of using technology in the community. Workshops at two of the three sites (Bristol and Middlesbrough) were conducted in person with residents in each area. The third co-production group, based in Hertfordshire, was convened and held online, with participants geographically spread across England. Five participants were invited to join the co-production workshops in Middlesbrough and Hertfordshire. Eight participants were recruited for the Bristol group. Anonymised participants' details are summarized in Table 1.

Workshops were delivered with the support of three third-sector organizations. In Bristol, workshops were facilitated with the assistance of Age UK Bristol. Age UK Bristol organizes information and awareness-raising campaigns and runs day centres, reminiscence services, befriending groups, and local exercise

classes for older people. In Middlesbrough, Rekindle, a participatory practice and co-production forum that fed into the development of social care services within the Middlesbrough council assisted in co-production workshops. An online co-production workshop was convened at the University of Hertfordshire with the assistance of Shaping Our Lives. Shaping Our Lives is a non-profit, user-led organization that works to promote the inclusive involvement of disabled people and those from other marginalized communities in activities that help shape policies and services. All three groups facilitated co-production activities by providing venues for the workshops, promoting the project, identifying, and recruiting older social care service users, and coordinating local travel arrangements for participants.

The objectives of the workshops were to identify what is important to older adults regarding care and how digital care services could be more effective in assisting them. During the co-production workshops, we aimed to understand how older people use digital care services, what types of challenges, barriers, and enablers they or their friends and neighbours have experienced through using technology in their daily lives, together with social care provision. It was anticipated that by involving older people in all parts of the project and through co-production workshops, they would be able to describe what is important to them in terms of digital care, and whether current services assist them in their daily lives.

Four workshops were conducted between April and December 2024. Each workshop had a specific theme and set of activities – workshop one introduced the project and collected information about experiences of engaging with technology in general and social care technologies specifically. Workshop two identified special priorities for social care service delivery and specific technologies that met these priorities. The third workshop explored key outcomes, facilitators, and barriers for technologies and reported service priorities for local authorities, identified in WP4. The final workshops identified key priorities for future research applications in the project and summarized the ongoing involvement in future research applications. Each participant received £75.00 per half-day workshop for their contribution and attendance alongside reimbursement for travel expenses, and where necessary, costs of any support required for an individual to participate in workshops (e.g., translation support, or presence of a support worker).

Informed consent was obtained from all participants at the beginning of each workshop. With participant consent, workshops were recorded to support analysis and interpretation, and extensive notes were taken. Discussions in each workshop were initially analysed by site leads (ML, JF, HRM) and then synthesized by the WP team. Notes and transcripts were analysed following Braun and Clarke's (2022) thematic analysis approach. A summary of the headline findings from each workshop is provided below:

Findings

Workshop 1 – experiences of using technologies in social care

Our participants reported varying levels of confidence and familiarity with technology. Some felt comfortable and capable, whereas others felt uncertain and anxious about using it. Although our participants felt that technology could help support aging in place, especially for older people living alone, experiencing mobility loss, or living with dementia, they raised concerns about the potential negative and unintended consequences of our increasing reliance on technology. For example, the move towards a cashless society and the growing dependence on online platforms for accessing services were highlighted as barriers. Our participants also discussed their concerns regarding data protection and the risk of scams. Whether these risks are real or perceived can significantly discourage older adults from engaging with digital technology, with associated effects on people's confidence and willingness to engage with social care technologies. Finally, while technology was seen as a useful tool for maintaining social connections with family and friends, there was a clear preference for it to complement, rather than replace, personal care, especially when it comes to technology-enabled health and social care.

Workshop 2 – Priorities for technology enabled social care delivery

In workshop two, our participants across sites emphasized that while technology can support older people, it is important that this is secondary to meaningful human care and connection. Technology must be simple, accessible, and reliable for acceptance and use. Whether discussing a need for reassurance, complex medication needs, care following a fall, or the broader issue of digital inclusion, all our participants shared their concern that technology alone cannot ensure safety, dignity, or well-being. Our participants shared the belief that informal, relational ways of checking, such as noticing small changes in routine, remain essential and often more meaningful than digital monitoring.

Key issues with technology include the usability of devices (especially for those with cognitive or physical impairments), importance of personal choice and privacy, and critical role of social networks in facilitating technology use. There must also not be over-reliance on family members; care responsibilities need to be more equitably shared and supported by community and statutory services. Technologies such as voice-activated assistants, medication carousels, fall detectors, and simple tablets were cautiously welcomed, but they needed to be in conjunction with trusted, ongoing human care and support. Participants also called for better access to information, support for digital literacy, and broader public awareness, underscoring the need for integrated care systems that balance technological innovation with the irreplaceable value of human connections.

Workshop 3 – Key outcomes, facilitators, and barriers

During the discussions, participants shared practical and ethical concerns about the use of technology for care, focusing on devices such as the Buddi GPS monitoring clip, medication dispensers, and remote monitoring systems. The Buddi GPS

Clip in Middlesborough was viewed positively for its simplicity and GPS features, but our participants raised concerns about how someone would go about setting it up, particularly if the person had poor digital literacy skills. Hertfordshire highlighted the need for telecare systems or wider technologies provided via social care to be reliable, accessible, sensitive, and which service users can easily be trained to use. Participants in Bristol were concerned with the ease of use of technologies provided by local authorities and proposed a "borrow bank" that would allow people to trial devices to decide whether they would be right for them. Overall, all our participants recognized the potential benefits of technology, but they also discussed ethical issues, including data privacy, affordability, and the need for human care.

When discussing medication dispensers, the participants expressed concerns about their complexity and reliability, especially for individuals with cognitive or physical impairments. Simpler manual systems such as dosette boxes were preferred by some, and there was strong emphasis on human support in medication management. Issues such as trust, digital literacy, and access to pharmacies were raised, with scepticism about technology fully replacing traditional systems without additional support. When discussing remote monitoring systems, our participants were open to using them but emphasized that these technologies should be introduced with clear communication, support, and respect for privacy. A significant theme and concern that has emerged from many of our discussions, across workshops and sites, is that technology should not replace human care. Rather, it should complement it with involvement from family and caregivers to ensure that the needs and preferences of the individual are prioritized.

Workshop 4 – Consensus priorities

The final workshops identified shared priorities among older adults in relation to the TECS. Across all three sites, participants consistently highlighted the need for clear signposting and accessibility of information, training, and ongoing support, and building trust in technology and services. In Middlesbrough, participants emphasized the need for clear and accessible information and highlighted the importance of trusted organizations, such as social services, in endorsing or recommending products to help older adults feel confident when using technology.

Our participants were concerned about scams, unreliable services, and a lack of data privacy. Our participants stressed the need for complementing, rather than replacing, human care with technology. Trust in local authorities or NHS-endorsed services was stronger than that in commercial offerings. Middlesbrough participants also raised concerns about high upfront costs, outdated technology, the need for personalized, ongoing training, and fragmented services. Hertfordshire participants all ranked the theme of signposting and information accessibility as the most important priority, with training, trust, and cost falling into mid-range priorities, and infrastructure considered the least important. In Bristol, although individual rankings varied, training and support were identified as the top priorities, followed by cost and access to information.

Participants raised several concerns and aspirations regarding how technology-enabled care services should be organized in the future. First, they wanted fewer devices that combined the functionality of all the devices currently on the market. Second, they wanted a 'trusted entity' to assess or rate the devices available to allow older people as future technology users/consumers to make informed decisions about how they spent their money on digital care and support. Finally, they highlighted that what they needed from the system was increased responsiveness, a characteristic that many were dubious that could be provided from more technology.

Discussion

The findings reported in this WP highlight broader concerns and issues that should be considered by local authorities and ICBs that wish to deploy TEC as part of their social care provision. The insights ascertained through these workshops align with and are associated with aging in place (van Hoof *et al.*, 2017), and age-friendly cities and communities (van Hoof *et al.*, 2025). The delivery of social care provision within the community via local authorities or ICBs aligns with Fulmer *et al.* (2020) 's broader discourse and age-friendly environment framework. There is an appetite for using TEC within the community social care context, based on the argument that such technologies will reduce costs and improve efficiency. Workshop participants acknowledged that the use and deployment of technologies in social care would potentially reduce costs for the NHS, despite limited evidence for the effectiveness of related technology delivered at scale (Woolham *et al.*, 2021). However, such accruals may be generated outside social care, creating an incentive not to provide such services if benefits are not experienced in social care unless such services are integrated – a goal of service reorganizations such as ICBs.

What was clear was the recognition among participants that there were no one-size fits all, or a silver bullet. Our communities and the people that live within them are not homogeneous, and service providers, local authorities, and ICBs must acknowledge their critical role in this discourse and their responsibility to ensure there is adequate and sufficient support in place (e.g., signposting, point of contact). However, local authorities and ICBs need to be mindful to ensure that not everyone in the community will have experience of using technologies and may not have familial support that they can ask to help them. What is needed and is demonstrated here through the findings of the various workshops, is motivation to use technology, knowledge, skills (digital literacy) support, point of contact, and appropriate signposting by service providers and local authorities alike to service users. Digital skills, broader knowledge pertaining to cybersecurity, and staying safe online (Marston, forthcoming) are vital when there is an intention to centrally place TEC to deliver social care.

Considering the findings presented here, we propose three key recommendations that we perceive as initial mechanisms for local authority and ICB social care provision.

Adequate signposting, and information seeking. This would include both digital and analogue forms of information sharing and reach residents who are not digitally connected (e.g., social media, email). Thus, they would not see local authority discoveries shared through mailing lists or Facebook pages.

Safety, security, and Trust. This relates to ensuring that data privacy is secure but also provides knowledge and information to users about cybersecurity information (e.g., password protection, 2-step authentication). Trust plays a significant role in the acceptance and effectiveness of technology (Lie *et al.*, 2016) and building trust can take time. Learning from peers in the community (Baker-Green, 2013) is imperative, and the work of the Rekindle group, together with evidence-based research (Baker-Green, 2013; see Marston *et al.*, 2022, Ch6) for more community suggestions.

Cost and finance are important for participants and community residents. The findings show that cost can be a barrier, but some are willing to pay for a service. However, not everyone in has the same level of finance. Many people live in poverty, hand-to-mouth, and this includes not only older adults but also younger vulnerable adults with disabilities (Earle & Blackburn, 2023; Marston, forthcoming). This theme needs to be unpacked more to understand whether finance is more important (Wasserman *et al.*, 2024) than other age-friendly domains (World Health Organization, 2007) being investigated (van Hoof & Marston, 2025; van Hoof *et al.*, 2025).

Work package 2 – Rapid scoping literature review on digital care technologies

WP2 undertakes a literature review and evidence synthesis of academic and practical literature to identify examples of novel digital care technologies in social care and to explore outcomes and effectiveness. We conducted two literature reviews: one focusing on novel digital care technologies to inform the DIALOGUE study and one that specifically supported the development of the NIHR HTA grant under Objective 4. This step was brought forward owing to changes in the work sequence of the DIALOGUE project, which occurred before the broader literature review was completed (after the systematic searches and during the screening process). The review was undertaken as a rapid scoping review following the staged approach developed by Arksey and O'Malley (Arksey & O'Malley, 2005) and Tricco *et al.* (Tricco *et al.*, 2015). Its reporting is based on PRISMA-ScR the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) (Tricco *et al.*, 2018) guidance with a PRISMA flowchart (Figure 1). We used Covidence software to support both screening and data extraction processes.

The research questions were developed from the DIALOGUE project objectives:

- What are examples of novel digital care technologies in social care?
- What is known about their experiences, outcomes, and effectiveness (including cost-effectiveness)?
- What recommendations have been identified by existing research that can inform the use and provision of digital care technologies?
- What information from existing research could inform the development of the HTA application?

Methodology

We collaborated with the King's College Library's Clinical Library Services to develop an effective search strategy. With the support of experienced librarian, a comprehensive systematic search design was established. Several concepts informed the search strategy: 'Intervention': synonyms for assistive technology, care technology, telecare, social care devices; 'Setting': community social care, own environments, assisted living; 'Population': older people, dementia. A systematic search of Ovid MEDLINE was conducted on April 28, 2024, yielding 3699 references. A second systematic search was conducted in Embase on May 20, 2024, yielding 8630 references. To include practice and grey literature, manual searches were undertaken on platforms such as the TECS Association, Digital Health and Care Institute, Social Care Institute for Excellence, and Google's search engine. Due to changes in the work sequence in the DIALOGUE project, the findings from this search, along with an additional systematic search, informed the development of the HTA bid, but not the wider literature review.

It was decided that while there were duplications, there was not enough time and resources in the study to complete the systematic screening of over 8000 references; therefore, the review concentrated on the references and publications yielded from the MEDLINE database. Although it is not uncommon for a rapid literature review and searches to use only one database (Klerings *et al.*, 2023), it is a limitation.

After the removal of duplications, 3689 references were included for initial title and abstract screening, and 276 publications were selected for full-text review.

Eligibility criteria

The eligibility criteria for screening publications were developed using the PICOS framework (Table 2), which defines the inclusion and exclusion keywords under the heading Population, Intervention/Exposure, Comparator/Context, Outcome, and Study Characteristics.

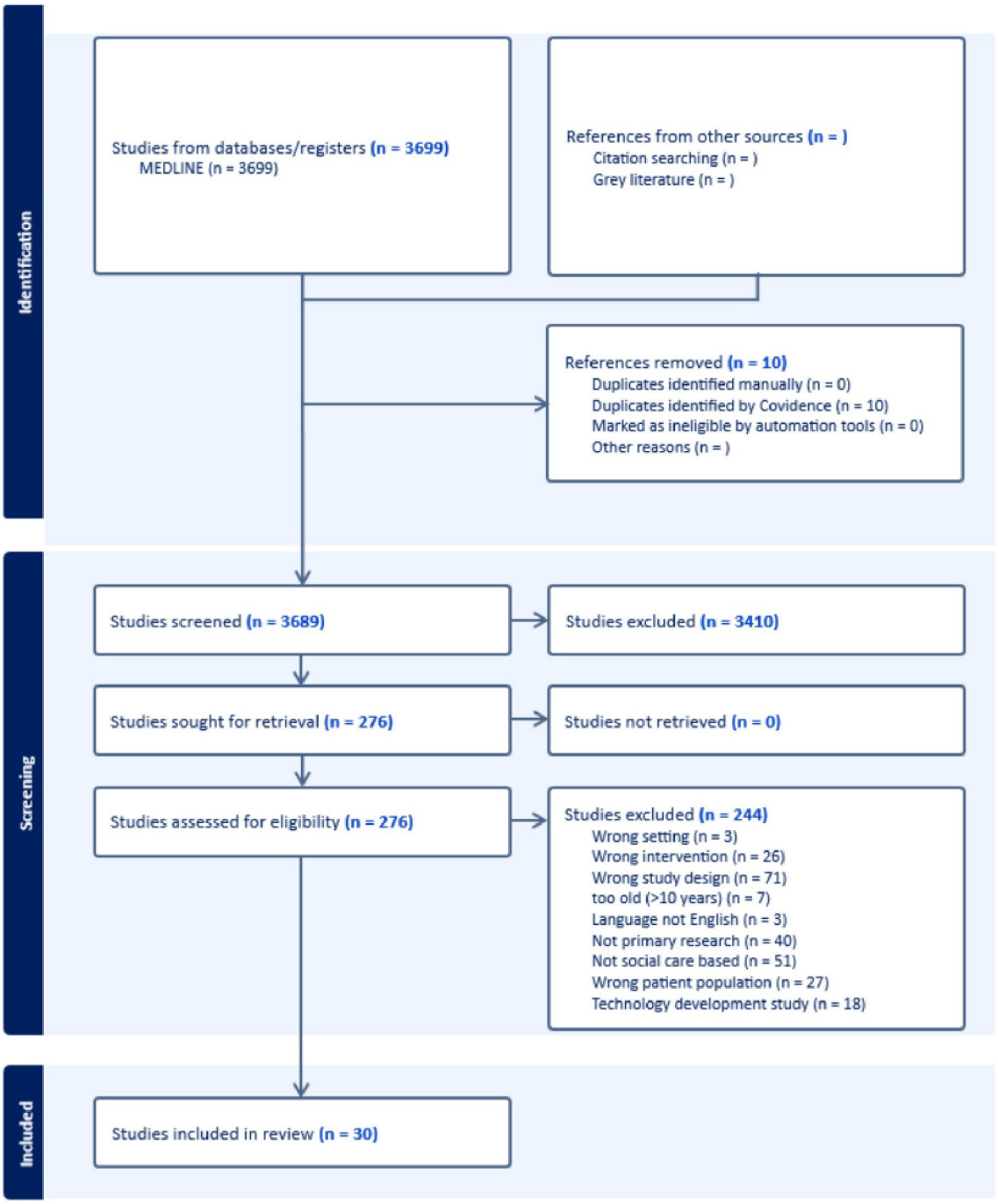

Figure 1. WP2 Scoping Review PRISMA Flowchart.

Criteria are summarised in Table 2:

Screening and analysis process

Three researchers (NS, CWN, and GG) engaged in the screening and extraction process. The screening process encompassed two stages: in the first stage, only the title and abstract were screened to determine which publications should be included in the second stage and the full-text screening. Two researchers screened all references. Using Covidence software ensured that researchers came to the same conclusion without knowledge of other researchers' decisions to reduce the risk of researcher bias.

Table 2. WP2 Scoping Review PICOS framework.

	Inclusion criteria	Exclusion criteria
Population	older people, people with dementia	publications solely on caregivers Studies < 5 participants
Intervention/Exposure	TECS currently being delivered within social care services/settings	clinical intervention, technology development studies, studies of companion robots
Comparator/Context	older people living at home/in community setting	primary healthcare
Outcome	focused primarily on social care outcomes/benefits for social care services	focus on medical/clinical outcomes, experiences solely due to Covid-19 pandemic
Study Characteristics	part of social care provision, English language, published in the last 10 years	trial registrations/protocols, literature and systematic reviews, conceptual and theoretical papers, opinion papers

Following the screening process, 30 publications were included in this review. Data were extracted from these publications by using a systematic template. The Covidence software provides a basic template, which was heavily amended to record additional, qualitative, information. One researcher performed data extraction using this template. A second researcher then checked the recorded data and amended if necessary. Finally, Covidence provides a collection of the extracted data in form of a downloadable file for further analysis. Reflecting use of a rapid review methodology, publications were not systematically assessed for quality.

The analysis used a thematic approach (Braun & Clarke, 2022) with a focus on experiences, effectiveness, and implications/recommendations. Two key frameworks were identified to inform the analysis. The first is the 'Evidence Standards Framework' (ESF), developed by the UK's National Institute for Health and Care Excellence (National Institute for Health and Care Excellence, 2025) and the second is the 'Non-adoption, Abandonment, Scale-up, Spread, and Sustainability' (NASSS) framework, developed by Greenhalgh *et al.* (2017). Both frameworks provide structured criteria for evaluating the effectiveness of technologies, acknowledging the complexities involved in the provision of care. However, it is important to note that both frameworks were primarily designed for the healthcare context rather than social care.

Following the data extraction process, it was found that six publications reported on two wider studies, the LIVE@Home.Path trial in Norway (Puaschitz *et al.*, 2021; Puaschitz *et al.*, 2023) and the ATTILA study in England (Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Howard *et al.*, 2021; Lariviere *et al.*, 2021). All publications were analysed to ensure that all data were included, but to avoid duplication, study characteristics are presented at study level, while data and findings are reported at publication level, reflecting varied analytical aims.

Findings

Of the 26 included studies, six were conducted in the United States of America (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Kerssens *et al.*, 2015; Rose *et al.*, 2018; Turner & Berridge, 2023; Warner & Tipping, 2022), five in Norway (Gedde *et al.*, 2021; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Øderud *et al.*, 2015; Puaschitz *et al.*, 2021; Puaschitz *et al.*, 2023). Two, one with four included publications, were conducted in the United Kingdom/England (Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Gibson *et al.*, 2015; Howard *et al.*, 2021; Lariviere *et al.*, 2021). Another two in the Netherlands (Bults *et al.*, 2024; Huygens *et al.*, 2021) and two in Sweden (Borg *et al.*, 2022; Malmgren Fänge *et al.*, 2020). There was one study each from Canada (Ault *et al.*, 2020), Finland (Nauha *et al.*, 2018), Germany (Megges *et al.*, 2018), Hong Kong (Lau *et al.*, 2019), Italy (Rossetto *et al.*, 2023), Singapore (Cao *et al.*, 2022), and South Korea (Kim & Jung, 2023). Two studies were multi-country studies, with Bergschöld *et al.*'s (2020) study conducted in both the Netherlands and Norway, and König *et al.* (2022) involving three countries: Austria, Spain, and Italy.

Aims and focus

As per the inclusion criteria, all studies explored or assessed effectiveness of technology or programmes involving technology, with two explicitly aiming to examine clinical effectiveness (Howard *et al.*, 2021; Megges *et al.*, 2018). The experience of using and potential acceptance of technology among the older people participants was examined in 14 studies (Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Borg *et al.*, 2022; Bults *et al.*, 2024; Cao *et al.*, 2022; Gibson *et al.*, 2015; Karlsen *et al.*, 2019; Kerssens *et al.*, 2015; König *et al.*, 2022; Lariviere *et al.*, 2021; Puaschitz *et al.*, 2023; Rose *et al.*, 2018; Turner & Berridge, 2023; Warner & Tipping, 2022), and three studies (Bergschöld *et al.*, 2020; Borg *et al.*, 2022; Cao *et al.*, 2022) also aimed to explore the selection of technologies by older people.

Several publications aimed to investigate the effectiveness for people with dementia and/or other cognitive impairments: nine publications (Arthanat *et al.*, 2024; Borg *et al.*, 2022; Gathercole *et al.*, 2021; Karlsen *et al.*, 2019; Kim & Jung, 2023; Malmgren Fänge *et al.*, 2020; Nauha *et al.*, 2018; Øderud *et al.*, 2015; Warner & Tipping, 2022) focussed on how technologies might be increasing their independence, four (Ault *et al.*, 2020; Curnow *et al.*, 2021; Megges *et al.*, 2018; 27) how technologies were impacting on certain symptoms, impact on safety was examined by seven studies (Arthanat *et al.*, 2024; Borg *et al.*, 2022; Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Lau *et al.*, 2019; Malmgren Fänge *et al.*, 2020; Warner & Tipping, 2022), three (Borg *et al.*, 2022; Jentoft *et al.*, 2014; Lariviere *et al.*, 2021) explored how technologies could improve social relationships and activities, and four (Bults *et al.*, 2024; König *et al.*, 2022; Lau *et al.*, 2019; Rossetto *et al.*, 2023) looked at effectiveness in more general terms.

This review does not include any publications that solely focus on family or unpaid carers/caregivers, nevertheless, due to involving multiple populations, 12 publications (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Berridge *et al.*, 2019; Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Lau *et al.*, 2019; Megges *et al.*, 2018; Nauha *et al.*, 2018; Puaschitz *et al.*, 2023; Warner & Tipping, 2022) also focussed on impact on carers, that is carer burden and quality of life, and six (Gedde *et al.*, 2021; Gibson *et al.*, 2015; Lariviere *et al.*, 2021; Puaschitz *et al.*, 2023; Rose *et al.*, 2018; Warner & Tipping, 2022) explored experiences and potential acceptance of technologies among carers. Three publications (Gedde *et al.*, 2021; Huygens *et al.*, 2021; Puaschitz *et al.*, 2021) aimed to investigate the nationwide access and routine use of technologies. Cost-effectiveness was given as an aim in three publications (Arthanat *et al.*, 2024; Gathercole *et al.*, 2021; Howard *et al.*, 2021).

Study design

Nine studies (Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Lariviere *et al.*, 2021; Malmgren Fänge *et al.*, 2020; 27) used qualitative research methods, six studies (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Cao *et al.*, 2022; Nauha *et al.*, 2018; Øderud *et al.*, 2015; Turner & Berridge, 2023) used a mixed-method design. Six publications (Gathercole *et al.*, 2021; Gedde *et al.*, 2021; Howard *et al.*, 2021; Puaschitz *et al.*, 2021; Puaschitz *et al.*, 2023; Rossetto *et al.*, 2023) reported a randomised controlled trial (RCT), with both the wider ATTILA study and the LIVE@Home.Path trial being RCTs. Quantitative designs were reported in additional studies, with two using a quantitative sample study design (Huygens *et al.*, 2021; Warner & Tipping, 2022), and one a secondary analysis of quantitative data (Curnow *et al.*, 2021). Two studies described a non-randomised experiment design (Kim & Jung, 2023; Lau *et al.*, 2019). The other studies described cross-sectional (Borg *et al.*, 2022), crossover sequence (Megges *et al.*, 2018), multi-centre field study (König *et al.*, 2022) designs, and one implementation study (Kerssens *et al.*, 2015).

Theory or theoretical models and frameworks

Nine publications (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Lariviere *et al.*, 2021; Megges *et al.*, 2018; Turner & Berridge, 2023) reported the use theoretical models and frameworks to inform and design their studies or sub-studies or to inform the analysis of data and findings. Three studies (Arthanat *et al.*, 2024; Bults *et al.*, 2024; Turner & Berridge, 2023) used theories pertaining to technology acceptance models (TAMs), such as the Unified Theory of Acceptance and Use of Technology (UTAUT), another naming the Healthcare technology acceptance model (H-TAM). Another study (Megges *et al.*, 2018) applied the User Experience (UX) concept, which overlaps in terms of its key aspects with other TAMs. Another two studies considered technology-focussed frameworks, such as the Human Activity Assistive Technology (HAAT) model (Arthanat *et al.*, 2024) and the concept of innosumption (Bergschöld *et al.*, 2020), which considers tools and practices. The other four studies described using hermeneutic phenomenology (Karlsen *et al.*, 2019), acculturation (Berridge *et al.*, 2019), social-situated learning theory (Jentoft *et al.*, 2014), and another study was informed by practice theory (Lariviere *et al.*, 2021).

Population

Sixteen publications (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Curnow *et al.*, 2021; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Kerssens *et al.*, 2015; Kim & Jung, 2023; Lariviere *et al.*, 2021; Malmgren Fänge *et al.*, 2020; Megges *et al.*, 2018; Nauha *et al.*, 2018; Puaschitz *et al.*, 2021; Puaschitz *et al.*, 2023; Turner & Berridge, 2023; Warner & Tipping, 2022) included older people with dementia, Alzheimer's or other cognitive impairments and their careers, including dyads, some of which had to live together to participate. Another eight publications (Bults *et al.*, 2024; Gathercole *et al.*, 2021; Gedde *et al.*, 2021; Howard *et al.*, 2021; König *et al.*, 2022; Lau *et al.*, 2019; Øderud *et al.*, 2015; Rossetto *et al.*, 2023) included older people with dementia, Alzheimer's, or other cognitive impairments solely. And six studies (Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Borg *et al.*, 2022; Cao *et al.*, 2022; Huygens *et al.*, 2021; Karlsen *et al.*, 2019) comprised the general older population.

Settings

Settings for the use or testing of technologies varied, but in the majority of 19 publications or 17 studies (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Cao *et al.*, 2022; Curnow *et al.*, 2021; Gedde *et al.*, 2021; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Kerssens *et al.*, 2015; Kim & Jung, 2023; König *et al.*, 2022; Lariviere *et al.*, 2021; Lau *et al.*, 2019; Megges *et al.*, 2018; Puaschitz *et al.*, 2023; Rose *et al.*, 2018; Rossetto *et al.*, 2023; Turner & Berridge, 2023; Warner & Tipping, 2022) it was the older person's own home, which could be a house or flat. Five publications, including the ATTILA and the LIVE@Home.Path trials, settings in addition to the home environment were considered, including supported and assisted living accommodation (Gathercole *et al.*, 2021;

Howard *et al.*, 2021; Nauha *et al.*, 2018) and inclusion of participants living in residential care homes (Øderud *et al.*, 2015; Puaschitz *et al.*, 2021). The other three studies were based solely on wider experiences connected to living in one's own home (Borg *et al.*, 2022; Bults *et al.*, 2024; Huygens *et al.*, 2021), Berridge *et al.* (2019) and Malmgren Fänge *et al.*'s (2020) studies focused solely on assisted living accommodation and facilities. Bergschöld *et al.*'s (2020) study focused on technology showrooms, where assistive technologies were demonstrated in older people.

Methods and measures used to explore experiences and assess effectiveness.

There were several categories of methods and measures to assess effectiveness: quantitative data from older people (Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Howard *et al.*, 2021; Kerssens *et al.*, 2015; Kim & Jung, 2023; König *et al.*, 2022; Lau *et al.*, 2019; Megges *et al.*, 2018; Nauha *et al.*, 2018; Rossetto *et al.*, 2023; Warner & Tipping, 2022), quantitative data from caregivers (Ault *et al.*, 2020; Gathercole *et al.*, 2021; Howard *et al.*, 2021; Kerssens *et al.*, 2015; König *et al.*, 2022; Lau *et al.*, 2019; Megges *et al.*, 2018; Nauha *et al.*, 2018; Warner & Tipping, 2022), qualitative data from older people and caregivers (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Cao *et al.*, 2022; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Kerssens *et al.*, 2015; König *et al.*, 2022; Lariviere *et al.*, 2021; Malmgren Fänge *et al.*, 2020; Øderud *et al.*, 2015; Rose *et al.*, 2018; Turner & Berridge, 2023; Warner & Tipping, 2022). There were also data collected from distinct groups of professionals, such as Huygens *et al.* (2021), but these were not reported directly in this review. Four studies (Ault *et al.*, 2020; Megges *et al.*, 2018; Nauha *et al.*, 2018; 27) used data collected using the technologies themselves, such as frequency of use. National survey data were used in two studies (Borg *et al.*, 2022; Huygens *et al.*, 2021).

Studies that investigated participant experiences collected demographic data. Several quantitative studies have used one or several validated measures or scales to assess the effectiveness of the use of technologies. We only reported those measures that were used in at least two different studies, with alternatives and sometimes study-developed measures used in others. Examples of validated quantitative measures administered to older people (or in some cases to caregivers as proxies), with some using translated versions, included: to assess cognitive function and status, the Mini Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA); quality of life was measured with the EuroQol EQ-5D-5L, while autonomy of daily living and ability to complete activities of daily living were measured with different instruments, such as the Modified Barthel Index. All studies that included unpaid carers measured aspects of caregiver burden, with one example of a validated measure repeatedly administered to caregivers being the Zarit Burden Interview (ZBI). Measures focusing on engaging with technologies were collected from 11 studies. The validated scales included the System Usability Scale (SUS), which provides efficiency output measures. Several studies have used various satisfaction measures. As will be reported in the limitations section, there was a lack of measuring experience of using technologies prior to the studies.

In terms of qualitative approaches, 15 studies (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Cao *et al.*, 2022; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Karlsen *et al.*, 2019; Kerssens *et al.*, 2015; König *et al.*, 2022; Malmgren Fänge *et al.*, 2020; Øderud *et al.*, 2015; Rose *et al.*, 2018; Turner & Berridge, 2023; Warner & Tipping, 2022) used interviews with older adults, caregivers, or both, with most having both pre- and post-intervention elements. Focus group discussions were conducted in two studies (König *et al.*, 2022; Øderud *et al.*, 2015), and observations in older people's homes and home visits in four (Arthanat *et al.*, 2024; Jentoft *et al.*, 2014; Lariviere *et al.*, 2021; Øderud *et al.*, 2015). Two studies (Øderud *et al.*, 2015; 27) also used qualitative surveys and two (König *et al.*, 2022; Nauha *et al.*, 2018) participant diary logs.

Cost-effectiveness and benefits were analysed in two studies: the ATTILA study (Gathercole *et al.*, 2021; Howard *et al.*, 2021) and to some degree in the study by Arthanat *et al.* (2024). While the ATTILA study used quality-adjusted life-year (QALY) measures and the EuroQol-5 Dimensions (EQ-5D) index, Arthanat *et al.* (2024) developed 'guiding questions' based on the Unified Theory for Acceptance and Use of Technology (UTAUT) to ask about perceived cost and benefits in interviews with participants.

Types of technologies deployed

There are different ways to summarize and categorize care technologies, whereby there is often an overlap between different categories given the potential complexity of systems and the rapidness of innovation (Doughty *et al.*, 2007; Greenhalgh *et al.*, 2018). Curnow *et al.* (2021) provides a list of possible categories of assistive technology installed in homes of people with dementia; the categories and grouped devices and equipment are similar to those used in this review, but also include a category 'basic AT' which includes pendant alarms alongside unmonitored sensors, which we have grouped under 'Emergency response' given that they require assistance from additional parties such as unpaid carers or response services. An additional categorisation by specific target participant or user group, aside from the general population of older people, can be derived by looking at the participant population categories, which indicates that the majority of technologies examined targeted people with dementia or other memory disorders, another target group were family and other unpaid carers.

Considering technology types, 15 studies (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Cao *et al.*, 2022; Curnow *et al.*, 2021; Gathercole *et al.*, 2021; Howard *et al.*, 2021; Kim & Jung, 2023; König *et al.*, 2022; Lariviere *et al.*, 2021; Lau *et al.*, 2019; Malmgren Fänge *et al.*, 2020; Nauha *et al.*, 2018; 27) involved systems or packages of interconnected devices and active or passive

sensors, reminders, and trackers. The digital platform was integrated into five studies (Berridge *et al.*, 2019; Bults *et al.*, 2024; Huygens *et al.*, 2021; Kerssens *et al.*, 2015; Rossetto *et al.*, 2023). Four studies focused on individual products or devices: GPS trackers were the focus of the studies by Megges *et al.* (2018) and Øderud *et al.* (2015); social/personal alarms in Puaschitz *et al.*'s (2021) publication; and a basic remote was assessed for its use and effectiveness by Jentoft *et al.* (2014). The other nine studies (Bergschöld *et al.*, 2020; Borg *et al.*, 2022; Gedde *et al.*, 2021; Gibson *et al.*, 2015; Huygens *et al.*, 2021; Karlsen *et al.*, 2019; Puaschitz *et al.*, 2021; Turner & Berridge, 2023; Warner & Tipping, 2022) explored general use, whereby participants have used or were planning on using different technologies which in itself were not compared; devices here were mainly personal alarms, reminders, monitoring sensors and GPS trackers, and digital platforms.

Rather than investigating the hardware and/or software systems or products themselves, five publications (Bergschöld *et al.*, 2020; Huygens *et al.*, 2021; Lau *et al.*, 2019; Turner & Berridge, 2023; Warner & Tipping, 2022) focused on technology education. This includes Turner and Berridge's (2023) publication, which introduced 'let's Talk Tech, described as a way to facilitate discussion among people with mild dementia and care partners around four kinds of technologies: location tracking, in-home sensors, web cameras, and virtual companion robots, leading to a structured technology use plan that aligns with the older person's needs, values, and concerns. In addition, Rossetto *et al.* (2023) explored a rehabilitation programme and Lau *et al.* (2019) involved signposting additional services as part of social care.

Findings on overall experiences and effectiveness

Several studies (e.g. Bergschöld *et al.*, 2020; Gibson *et al.*, 2015; Jentoft *et al.*, 2014; Nauha *et al.*, 2018) found that simple devices are often more useful and more aligned with users' and caregivers' everyday needs than complex systems, which are viewed as 'cumbersome' (Bergschöld *et al.*, 2020) and carers' especially seek simplification (Bergschöld *et al.*, 2020; Jentoft *et al.*, 2014). Similarly, Arthanat *et al.* (2024), Jentoft *et al.* (2014), and König *et al.* (2022) found that traditional methods are often preferred, as they feel more familiar, intuitive, and secure, potentially limiting their willingness to adopt new technologies, regardless of efficiency. König *et al.* (2022) also found that the more technologies used, the more positive they were perceived. As Cao *et al.* (2022) indicated, adoption and acceptance rely on both intrinsic and extrinsic factors. Two studies (Gibson *et al.*, 2015; Lariviere *et al.*, 2021) identified perceived technologies as a threat to replace personal care, with participants in Gibson *et al.* (2015) calling technologies a 'necessary evil.'

Findings on design and technical aspects

Connected to potential scale-up and sustainability, design and technical aspects were discussed in seven studies (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Bults *et al.*, 2024; Jentoft *et al.*, 2014; König *et al.*, 2022; Megges *et al.*, 2018; Nauha *et al.*, 2018), with providing a language choice (Bults *et al.*, 2024) and appropriate sized devices (Bults *et al.*, 2024) being some identified positives, while fragility of products (Ault *et al.*, 2020), poor sound quality (Nauha *et al.*, 2018), software not working (Bults *et al.*, 2024), connectivity issues and limitations (Bults *et al.*, 2024; Megges *et al.*, 2018; Nauha *et al.*, 2018), and missing interoperability with external devices, e.g. own mobile phone (Bults *et al.*, 2024) being found as factors that needed more development. König *et al.* (2022) found that poor design could add to the stigmatization associated with care devices.

Use and acceptance among older people, including those with cognitive impairments

This section explores the reasons why older people, including those with cognitive impairments, accepted care technologies and factors influencing technology acceptance.

Two studies (Bergschöld *et al.*, 2020; Gathercole *et al.*, 2021) reported a limited fit between care needs identified in assessments, technological recommendations, and installation. Gathercole *et al.* (2021), for an English context, found that 62% of provided devices were not identified during assessment and 53% of recommended devices not being installed.

Acceptance and ongoing use was associated with usefulness and achieving intended outcomes (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Karlsen *et al.*, 2019; Kim & Jung, 2023; Lau *et al.*, 2019; Warner & Tipping, 2022), for example increased independence and living at home for longer (Huygens *et al.*, 2021; Karlsen *et al.*, 2019; Malmgren Fänge *et al.*, 2020; Øderud *et al.*, 2015), improved quality of life (Huygens *et al.*, 2021; Øderud *et al.*, 2015), perceptions of increased safety (Cao *et al.*, 2022; Karlsen *et al.*, 2019), or by preventing potentially harmful incidences such as wandering in people with dementia (Lau *et al.*, 2019; Øderud *et al.*, 2015), and leisure activities (Bults *et al.*, 2024; Jentoft *et al.*, 2014; Kerssens *et al.*, 2015; Øderud *et al.*, 2015), though many people with dementia needed assistance in this context. Huygens *et al.* (2021) found that it was sometimes difficult for professionals to estimate whether an older person would accept technologies or not, which points towards the importance of thorough initial assessments and reviews (Bergschöld *et al.*, 2020; 05). However, Bergschöld *et al.* (2020) also found that access to formal provision of care technologies could be a complex bureaucratic process, and people with dementia need more professional support to successfully participate in the selection of assistive devices (Borg *et al.*, 2022).

Several studies have indicated that care technologies are perceived as most useful if it is possible to integrate them into everyday practices, ensuring that use becomes habitual (Arthanat *et al.*, 2024; Bergschöld *et al.*, 2020; Jentoft *et al.*, 2014; Øderud *et al.*, 2015). Some studies (Jentoft *et al.*, 2014; Øderud *et al.*, 2015) have found that the introduction of devices and systems at the onset of disease aids learning and integration in daily life. Kerssens *et al.* (2015), König *et al.* (2022), and Nauha *et al.* (2018) found that when devices did not achieve their intended outcomes, they were not considered useful.

When compared with older people without dementia, Borg *et al.* (2022) found in their nationwide study on technology provision by municipalities that older people with dementia used fewer assistive devices and products and benefitted less from them than older people without cognitive impairments. Gibson *et al.* (2015) found that users with dementia found at least some devices to be intrusive and irritating, Kerssens *et al.* (2015) reported that in their study people with dementia were not irritated, and Malmgren Fänge *et al.* (2020) found that most participants with dementia were not aware of the technologies.

Non-adoption and abandonment

Barriers to adoption and reasons for abandonment among older people include deterioration of cognitive impairment (Øderud *et al.*, 2015) or physical limitations (Kerssens *et al.*, 2015) that make continuous use of technologies unviable. Concerns around affordability include the cost of initially buying and installing devices and ongoing costs such as fees or increased electricity use were found in three studies (Bults *et al.*, 2024; Cao *et al.*, 2022; Gibson *et al.*, 2015). Lack of trusting devices (Berridge *et al.*, 2019; Cao *et al.*, 2022) and ethical concerns about lack of privacy and monitoring have been raised in some studies (Bults *et al.*, 2024; Cao *et al.*, 2022; Malmgren Fänge *et al.*, 2020), whereas Øderud *et al.* (2015) found that this was not an issue for the majority of participants using GPS trackers in their study. Puaschitz *et al.* (2023) reported that about half of the participants with dementia in their study around personal alarms were unaware of having social alarms installed, explaining their non-usage. They also found that compared to their caregivers, people with dementia were more likely to say that personal alarms gave them a false sense of security (28% vs. 9.9%), potentially due to their former experience of falls and increased anxiety.

Experiences and outcomes for family carers and unpaid caregivers

One of the main aims of providing and using technology is to decrease caregiver stress and/or caregiver burden. Overall, the effectiveness of technologies for carers depends on several factors, including knowledge, timing, ongoing professional support, and the quality and usability of the technology itself. The studies examined in this review have shown some positive impacts of technologies on unpaid carers, with others finding no differences and some reporting notable challenges. As with older people, studies found that simplicity and technology that achieved the intended use and outcomes were positive (Arthanat *et al.*, 2024; Lau *et al.*, 2019; Nauha *et al.*, 2018; Øderud *et al.*, 2015; Rossetto *et al.*, 2023; Warner & Tipping, 2022), although Lau *et al.* (2019) reported that the intended outcomes had no lasting effect at one year. Several studies (Gibson *et al.*, 2015; Kerssens *et al.*, 2015; Lau *et al.*, 2019; Rossetto *et al.*, 2023; Warner & Tipping, 2022) have indicated that technologies can decrease caregiver stress and provide emotional relief by offering peace of mind. Karlsen *et al.* (2019) and Malmgren Fänge *et al.* (2020) identified emotional ambivalence among carers, who appreciated that support devices and systems could offer in enabling older people to stay living at their own homes, but also experienced stress from responsibilities connected to using care technologies.

König *et al.* (2022), Gathercole *et al.* (2021), and Kerssens *et al.* (2015) found no significant decrease in caregiver burden, and Bergschöld *et al.*'s (2020) study reported an increased burden due to the requirement of caregivers to function as enablers. Technical issues such as delayed alarms and reliability problems have also been reported to have a negative impact on caregivers (Malmgren Fänge *et al.*, 2020). Many caregivers struggle with a lack of formal support (Gibson *et al.*, 2015; Karlsen *et al.*, 2019). Lariviere *et al.* (2021) found that, while most carers were able to adapt care technology to their routines, success varied. Bults *et al.* (2024) and Jentoft *et al.* (2014) reported decreases in caregiver burden but only after an initial increase during adoption and implementation. Warner and Tipping (2022) further noted that caregivers experienced improved self-assurance, greater knowledge in managing challenging behaviours, and a reduced need for constant attention to daily tasks. Technologies have also been reported to reduce feelings of being housebound among caregivers (Karlsen *et al.*, 2019; Øderud *et al.*, 2015).

Intervention effectiveness and treatment effects

Several studies have investigated the effectiveness of interventions for people with dementia and other cognitive impairments with mixed findings. Lau *et al.* (2019) found improvements in reducing wandering, and Rose *et al.* (2018) reported that sensors were useful for determining agitation, sleep, and incontinence. Rossetto *et al.* (2023) reported that the ABILITY intervention led to improvements in global cognition, particularly in language, executive function, and memory, with some evidence of long-term effects. Kim and Jung (2023) found statistically significant positive effects on cognitive function in individuals with mild cognitive impairment, but not in those with dementia, and improvements in criteria such as quality of life, daily living, mood (depression and anxiety), and satisfaction in both disease groups. However, other study outcomes were less positive. Kim and Jung (2023) noted no significant effects on instrumental activities of daily living (IADLs). More critically, publications on the ATTILA study (Gathercole *et al.*, 2021; Howard *et al.*, 2021) found that comprehensive assistive technology and telecare packages did not yield improvements in the time spent living at home, safety, or quality-adjusted life years. In some cases, participants receiving a full ATT package reported poorer quality of life than those receiving only basic support.

Cost-effectiveness

An economic analysis of assistive technology and telecare interventions for people with dementia as part of the ATTILA study found no significant cost-related benefits. Gathercole *et al.* (2021) reported that after 104 weeks, there were no significant differences between the intervention and control groups in terms of health and social care resource use or overall societal costs. Howard *et al.* (2021) reported no evidence of cost-effectiveness when assessing days lived in the community, health-related quality of life, or quality-adjusted life years (QALYs) based on proxy-reported EQ-5D.

Discussion: preconditions, implications, and recommendations

Turner and Berridge (2023) found that adoption, continuous use, or discontinuation of one intervention or technology does not predict using or not using others, and Puaschitz *et al.* (2023) discussed that access to and acceptance of technology is not the same as actual successful and sustained usage. For digital technologies to work effectively and be integrated successfully into social care for older people, particularly those with cognitive impairments such as dementia, and their family or unpaid carers, the publications discussed key preconditions and provided useful recommendations.

Technologies need to be user-friendly, intuitive, and simple to use, especially if they are to be used by people with cognitive impairments (Jentoft *et al.*, 2014; Megges *et al.*, 2018; Nauha *et al.*, 2018). This does not exclude multidimensional solutions, but they need to be easily approachable or well supported by professionals (Lau *et al.*, 2019), and they should preferably allow for some form of control. Technologies need to be adaptable and tailored to changing and evolving individual needs, and their supply should be person-centred rather than technology- or provision-led. Social care providers must also ensure that devices and systems work in real-world settings (Gathercole *et al.*, 2021; Gibson *et al.*, 2015; Nauha *et al.*, 2018).

Assessments as part of care technology provision must be comprehensive so that the most suitable technologies are implemented, with regular follow-up and review to adapt technology provision when there are changes in needs and abilities or better solutions become available (Borg *et al.*, 2022; Cao *et al.*, 2022; Curnow *et al.*, 2021; Huygens *et al.*, 2021; Øderud *et al.*, 2015; Puaschitz *et al.*, 2023). Sometimes, this can be the least intrusive intervention rather than a full package of devices. Assessments also need to consider unpaid carers' abilities, capacity, and the relationship with the person drawing on care. It is important that assessors are sufficiently trained and experienced to make appropriate decisions on the provision of devices and services so that technologies are used in an optimized and sustainable manner (Curnow *et al.*, 2021; Gibson *et al.*, 2015; Huygens *et al.*, 2021; Øderud *et al.*, 2015).

Carers are essential in creating technologies for older people. Although devices and/or applications can reduce caregiver stress and burden, they often add new tasks to caregivers' responsibilities. Comprehensive information, support, and training on devices and systems are needed to ensure that technologies do not become a burden on themselves. Several studies have found that technologies do not necessarily reduce the carer burden (e.g. Bults *et al.*, 2024; Karlsen *et al.*, 2019; Kerssens *et al.*, 2015; Megges *et al.*, 2018). Kerssens *et al.* (2015) noted that expectation management might be needed to avoid or reduce carers' abandonment because of unfulfilled expectations. The importance of involving caregivers in the assessment process has been mentioned above.

Ethical concerns, particularly regarding privacy, data protection, autonomy, and personal dignity, should be addressed during design, development, and provision (Malmgren Fänge *et al.*, 2020; Megges *et al.*, 2018; Øderud *et al.*, 2015). In addition to ethical challenges, cultural sensitivities and concerns need to be considered to ensure that cultural values and expectations around caregiving are addressed. Berridge *et al.* (2019) highlight the pivotal role that professionals (social workers) can play as 'cultural brokers' helping to overcome challenges related to language, trust, and access to technologies.

Early introduction of technologies in the care process enhances effectiveness, as their use can become familiar and habitual, particularly for people with a diagnosis of dementia and other cognitive impairments, as their capabilities might decrease (Arthanat *et al.*, 2024; Jentoft *et al.*, 2014; Malmgren Fänge *et al.*, 2020; Øderud *et al.*, 2015). Additionally, a general positive attitude towards technology is vital for the adoption of devices and systems in everyday life, regardless of age (Bults *et al.*, 2024; Jentoft *et al.*, 2014; König *et al.*, 2022). Prior positive experiences using technologies can help, whereas negative experiences may create challenges (Cao *et al.*, 2022).

Costs associated with implementation and ongoing costs can be barriers to adoption and continued use (Bults *et al.*, 2024; Cao *et al.*, 2022; Gibson *et al.*, 2015), public sector provision and involvement can help here. Do-it-yourself (DIY) solutions can be cost-effective alternatives to specialized care technologies and high-tech systems, as Bergschöld *et al.* (2020) reported. They are often perceived as easier to adopt and more pragmatic to use and are available without the additional task of receiving them through formal social care providers. Bergschöld *et al.* (2020) advocated that greater attention should be paid to low-tech solutions.

Information and ongoing training and support are essential for the adoption and continuous, successful use of technologies. Older people have greater interest and understanding than is sometimes expected. However, the lack of digital literacy among older people and their caregivers was seen as a vital barrier to interest in and access to novel digital devices and applications, alongside traditional devices such as personal alarms, as Puaschitz *et al.* (2021) found. This can be overcome with better information and updates on technological developments (Kerssens *et al.*, 2015; Puaschitz *et al.*, 2021).

Malmgren Fänge *et al.* (2020), Øderud *et al.* (2015), and Warner and Tipping (2022) stressed that technologies should complement and be integrated with other social care provisions in place. It should not be seen or used to replace personal care without comprehensive assessment or regular review. Integration with other available community care provisions also relieves family carers and allows them to 'maintain the role of a relative' rather than a constant caregiver, as Malmgren Fänge *et al.* (2020 p. 654) noted. When complex multi-device and-dimensional systems and programs are considered, they need support from professionals who understand both the technologies and personal needs. Reliable access to professionals and collaboration between carers and professionals allows for the successful adoption and adjustment of technologies (Jentoft *et al.*, 2014; Øderud *et al.*, 2015). A trustful relationship with

care professionals and services can have an impact on initial openness to technology adoption (Bults *et al.*, 2024; Cao *et al.*, 2022). Karlsen *et al.* (2019) pointed out that engaging with telecare services is often an additional responsibility for unpaid carers. Finally, technologies need to be designed in collaboration with professional technical designers and engineers and older people, including those with cognitive disabilities, unpaid carers, community services, and formal social care providers (Cao *et al.*, 2022; Gathercole *et al.*, 2021). This should also include representatives from diverse ethnic and cultural backgrounds as recommended by Bults *et al.* (2024).

Limitations reported by studies (publication level)

Twenty of the 30 examined publications reported limitations, affecting and restricting the reliability, scope, or generalization of study findings. Several of the studies were exploratory or pilot studies, which may explain why 12 had a small sample size or cohort (Arthanat *et al.*, 2024; Ault *et al.*, 2020; Berridge *et al.*, 2019; Bults *et al.*, 2024; Curnow *et al.*, 2021; Kerssens *et al.*, 2015; König *et al.*, 2022; Malmgren Fänge *et al.*, 2020; Megges *et al.*, 2018; Rose *et al.*, 2018; Rossetto *et al.*, 2023; Turner & Berridge, 2023) and four had a convenience cohort or clustering (Arthanat *et al.*, 2024; Berridge *et al.*, 2019; Howard *et al.*, 2021; Puaschitz *et al.*, 2021). While small numbers usually do not allow for wider generalization, Borg *et al.* (2022) stated that their large sample size might have affected the statistical analysis and significance, and König *et al.* (2022) felt that the heterogeneity among participants in their study was a limitation.

Several studies have reported limitations in data collection and analysis. While Warner and Tipping (2022) noted that inconsistent data management hampered the evaluation, two studies (Ault *et al.*, 2020; Rose *et al.*, 2018) reported data loss due to technical issues, and another three (Arthanat *et al.*, 2024; Howard *et al.*, 2021; Kerssens *et al.*, 2015) reported missing data at the follow-up data collection point. Not collecting data on technology use experience at baseline was reported as a limitation in two studies and three publications (Bults *et al.*, 2024; Puaschitz *et al.*, 2021; Puaschitz *et al.*, 2023). The participants' use of medication may have affected the study by Rose *et al.* (2018). Malmgren Fänge *et al.* (2020) found that interviewing older adults and caregivers together might have limited the disclosure of sensitive experiences. Bults *et al.* (2024) used care professionals as interpreters, potentially adding a bias to their study. Similarly, in Berridge *et al.* (2019), it was the data from social workers' reports rather than from older people or caregivers who informed the study.

Work package 3 –pilot process evaluation of digital post hospital discharge and reablement services

WP3 explored the current processes and practices involved in localized TECS at all three study sites, with a particular focus on emerging or established service delivery models supporting post hospital discharge and reablement services for older adults in the project's three regional sites (Southwest – Bristol, North Somerset, and South Gloucestershire, North East – Middlesbrough, and Central – Oxfordshire).

Digitally enabled, post hospital discharge and reablement services (PHDRS) were selected as a priority to focus on for this work package, as identified through previous consultations with councils in Middlesbrough and South Gloucestershire and the Bristol, North Somerset, and South Gloucestershire Integrated Care Board (BNSSG ICB). At the point of application for our NIHR Health Technology Assessment Accelerator Award, the Middlesbrough Council and BNSSG ICB had also begun local pilot projects to assess the potential cost savings and effectiveness of PHDRS to reduce the length of hospital stay for older patients. As such, the PHDRS evolved into a priority service within participating fieldwork sites, justifying their inclusion as a series of focal interventions for process evaluation.

To fulfil this work package's aim, the team attempted to answer the following main research question:

What are the current processes and practices for digitally enabled, post hospital discharge and reablement services (PHDRS)?

To generate the granular data required to answer this research question, the following sub questions were developed:

1. What are localised digitally enabled care services?
2. What technologies are offered as part of these localised services?
3. What does localised PHDRS entail?
4. How does PHDRS differ from routine technology-enabled care services?
5. What are the experiences of clients using local PHDRS?
6. What data do the PHDRS generate? How are these data used to inform the local practices and policies?

Methodology

This work package involved a pilot process evaluation to explore the current processes and practices of the PHDRS across the three study sites. The process evaluation was provided by the Medical Research Council's guidance for the process evaluations of complex interventions (Moore *et al.*, 2015) and its revised recommendations with the National Institute of Health and Care Research (Skivington *et al.*, 2021). These frameworks represent an agreed-upon framework to inform the evaluation of complex interventions for applied health and care research in the UK. PHDRS are complex interventions for several reasons. First, the technology works across multiple integrated care boards, including hospital trusts, local authorities with adult social care responsibilities, and, at times, technology providers and call centres as part of this wider ecosystem. The deployment of PHDRS requires coordination, communication, and accountability by all actors involved in the delivery of PHDRS rather than a single provider organization.

Previous studies have argued that all digital care technologies are necessarily complex, as they intervene in both the social, material, and care dimensions of a person's life (Hamblin & Lariviere, 2023) based on the installation and space technology occupies, habituated use of the technology changing routines, and changes to care relationships and practices of caring (Lariviere *et al.*, 2021).

Rather than a full-scale process evaluation, this work package sought to 'map' the different interventions on offer and processes of delivery than attempt a normative evaluation of the different service models. To identify the interventions and processes, the work package team conducted semi-structured interviews with strategic leads within the partner sites (N=12) and appraised the data collected from the pilot projects within the Bristol region and Middlesbrough.

Semi-structured interviews were conducted online by the WP lead (ML) and recorded via MS Teams. Automatic transcripts were generated via native Teams software functionality and checked for quality by reading them with the audio of the recording. Transcripts were analysed via qualitative framework analysis (Goldsmith, 2021; Klingberg *et al.*, 2024). Framework analysis was selected as the deductive analytical requirement based on a narrow focus on how PHDRS were delivered in local contexts rather than an inductive inquiry to explore unanticipated phenomena within the topic area. The data matrix was informed by the Non-adoption, Abandonment, Scale, Spread and Sustainability (NASSS) framework (Greenhalgh *et al.*, 2017), our in-depth findings are published elsewhere (forthcoming). For this NIHR Open Research Report, the team provided an overview of the work package's findings.

Overview of findings

This section provides a concise summary of the findings from the pilot process evaluation, notably the mapping of different service models and technologies of PHDRS within Bristol, Oxfordshire, and Middlesbrough. Two distinct service models were identified at three study sites. In Bristol, the PHDRS was coordinated at the regional level by the BNSSG ICB. The ICB includes three regional local authorities (the Bristol City Council, North Somerset Council, and South Gloucestershire Council), all hospital trusts, local charities, and industry partners. One industry partner, Sirona Health and Care, has historically provided telecare services in the region alongside localized provisions offered by the three local authorities' technology-enabled care (TEC) teams. For the ongoing piloting of the PHDRS in the region, Sirona was contracted to work directly with hospitals to provide technology as part of care packages for older people being discharged following a professional needs assessment conducted by a health professional in the hospital wards. Sirona would ensure that the technology was installed with the person when they arrived at the hospital and would maintain free access to the technology for eight weeks. After the initial eight-week period, the older person could continue to use the technology with Sirona (for a fee), be transferred to their local authority's TEC team, or request that the technology be withdrawn from their care package.

In Oxfordshire and Middlesbrough, the local authority TEC teams were the sole organizations responsible for providing PHDRS for older people in their respective areas. Local authority TEC teams would work with hospital staff to identify how digital technology could be meaningfully included in the older person's care package to support their timely discharge from hospital back to their home or other care settings. The TEC teams similarly offered PHDRS technology for free for an eight-week period. After the initial eight-weeks had elapsed, the older person could decide to continue to pay for the technology or request its removal.

The differences in service models were informed by the people in the different localities perceived as localized issues. For the Bristol region, the hospitals in the area were concerned about time delays in waiting for one of the three local authorities to match a person to relevant technologies and have them installed before discharge could be processed. They were also concerned that each local authority had its own 'menu' of technology rather than a harmonized set of technologies shared within the region, leading to concerns that people may not have the 'right' technology available to them if there was not a contract with the relevant technology provider in place in that local authority catchment area. By working with Sirona Health and Care, they could ensure that all older people would receive access to the same range of technologies, whether they lived in Bristol, South Gloucestershire, or North Somerset. Conversely, in Oxfordshire and Middlesbrough, the local authority TEC teams felt it was important to have local ownership of PHDRS, as technology-enabled care is one of the few services that makes money for resource-constrained local authorities providing social care services. Many local authorities have sustained partnerships with hospital trust and other health authorities for several years. These TEC teams have learned how to demonstrate their value and work alongside their health colleagues in multi-disciplinary teams, with TEC teams enabling their PHDRS to be managed by these public actors instead of a private partnership.

Technologies provided

For the PHDRS, the technology provided as part of the service includes a broad range of analogue and digital devices. The participants described the following technologies as part of the service: motion sensor lights, digital pendant alarms, memory clocks, fall detectors, chairs and bed sensors, and passive IR activity monitoring systems. These technologies were offered at all the three regional sites. Bristol and Oxfordshire also began to evaluate novel digital technologies, including acoustic monitoring for people discharged into care homes (Bristol region) and voice-activated computer assistant technologies, such as Alexa (Oxfordshire), to expand their offers beyond traditional telecare service models. All technologies offered for the PHDRS were the same technologies already embedded within the local authority TEC teams and Sirona's routine TEC provision. No technologies were specifically identified or adapted to support the PHDRS. Instead, the three sites attempted to repurpose technologies routinely offered by their TEC teams in this new context (post hospital discharge and

reablement) to bridge the gap between health and social care services.

Discussion

The work package has identified two service models and the rationales for their use that are currently used to offer PHDRS in England. The distinction between these service models reflects concerns about key outcomes (timely discharge from hospital), ownership of services and local revenue generation, and perceptions of equity in TEC provision interpreted in individual organizations and across regional partnerships. The full range of partners involved across the PHDRS nexus, including local authorities, NHS trusts, integrated care boards, and technology suppliers identified in DIALOGUE, requires more granular analysis that can 'follow' the processes of provision within and across these actor-sites as part of a larger evaluation of the effectiveness of PHDRS.

Work package 4 – Core technologies and outcomes

WP4 used a combination of an e-Delphi study and accompanying consensus workshops to collate complex information from a group of experts in social care (Black *et al.*, 1999; Hsu & Sandford, 2007). In this case, we asked local authority (LA) employees across the three fieldwork sites who worked with technology-enabled care for older people to participate in the e-Delphi exercise. The aim was to reach a consensus on the facilitators of and barriers to TEC adoption. As the LAs involved were geographically diverse (e.g., Middlesborough, North Somerset, Oxfordshire, and South Gloucestershire), we adopted an e-Delphi process (Donohoe *et al.*, 2012; Toronto, 2017). The survey instruments and consensus workshops were conducted online using an online survey platform (JISC Online Surveys) and a digital collaboration platform (Microsoft Teams).

Similar to previous e-Delphi studies on social care for older people, we planned three rounds of surveys to reach a consensus (Shepherd *et al.*, 2017). However, after two rounds, we established a consensus at the 80% agreement level, which is the most widely used measure in e-Delphi studies (Diamond *et al.*, 2014). Therefore, we stopped after two rounds of surveys and held a consensus workshop in the third round to gather further qualitative insights. In survey two, we selected four themes to explore in more depth (e.g., Q1, Q3, Q4, and Q7) (Figure 2). Respondents were asked to provide agreement on the results of survey one, rank answers, and qualitatively comment on how TEC alters the fundamentals of care work, why people with dementia benefit the most and why family caregivers benefit the least from TEC, how to measure TEC priorities, and how to reduce barriers to TEC. Findings from surveys one and two were then presented at an online consensus workshop with TEC leads and staff involved in TECS delivery within the three fieldwork sites.

Fifteen employees from four LAs participated in the e-Delphi exercise. Table 3 shows the characteristics of these respondents, including their age, gender, job role, and survey completion. There were 12 responses to the first survey and eight responses to the second survey, with five respondents who completed both surveys. There were three new respondents for the second survey, but they represented LAs from the previous round and provided insights into TEC provision for their LA. There were

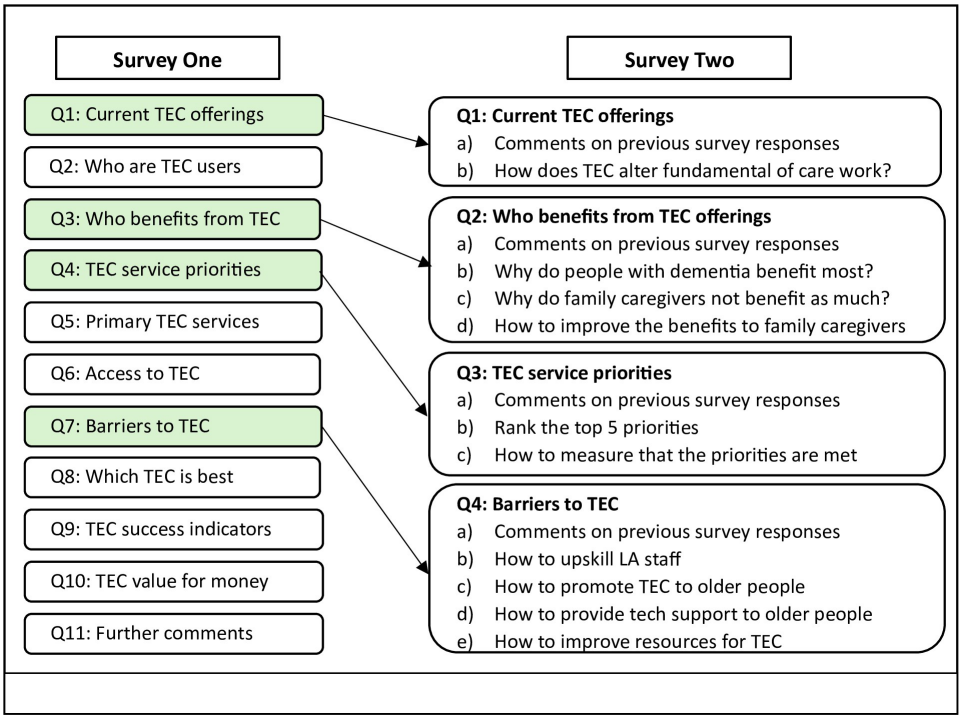

Figure 2. WP4. e-Delphi Survey 1&2 list of survey questions.

Table 3. WP4 e-Delphi exercise. Participant Information characteristics.

Participant number	Age	Gender	LA	Job Role	First survey	Second survey
1	35	Female	Middlesbrough Council	Adult Social Care worker	Yes	
2	35	Male	Middlesbrough Council	Adult Social Care worker	Yes	Yes
3	37	Male	Middlesbrough Council	Assistive Technology Technician	Yes	
4	39	Female	Middlesbrough Council	Service Coordinator		Yes
5	43	Female	Middlesbrough Council	Team Lead	Yes	Yes
6	50	Male	Middlesbrough Council	Service Lead		Yes
7	27	Female	North Somerset Council	Manager		Yes
8	44	Female	North Somerset Council	Manager	Yes	
9	38	Female	Oxfordshire County Council	Digital Health & Care Lead	Yes	Yes
10	39	Female	Oxfordshire County Council	Health and Care IOfficer	Yes	Yes
11	41	Female	Oxfordshire County Council	Occupational Therapist	Yes	
12	41	Female	Oxfordshire County Council	Occupational Therapist	Yes	
13	43	Male	Oxfordshire County Council	AT Coordinator	Yes	Yes
14	56	Female	Oxfordshire County Council	Team Leader	Yes	
15	54	Female	South Gloucestershire Council	Team Manager	Yes	

four males, and 11 females aged between 27 and 56 years, with an average age of 41. There were six from Middlesbrough Council and Oxfordshire County Council, and from within BNSSG ICB, two were from North Somerset Council, and one from South Gloucestershire Council. Job roles include social care, technology and innovation, service providers, managers, and occupational therapists.

Results

Survey one: foundational knowledge

Table 4 presents the results of the first survey. For TEC offered by LAs, 100% (N=12) provided telecare and GPS monitoring services, 92% (N=11) provided community pendant and monitoring services, and 83% (N=10) provided fall detection and prevention services and general household aids/adaptations for activities of daily living (e.g., kettle tippers and household appliances). The main users of these TEC were people aged 75–84 (92%, N=11), living with dementia (92%, N=11), aged 65–74 (83%, N=10), with frailty (75%, N=9), and aged 85+ (58%, N=7). Those who benefit the most from digital technologies are generally the same as those who use them, although some differences emerge. People living with dementia were most frequently identified as beneficiaries (92%, N=11), followed by individuals aged 65–74 years (83%, N=10), those with frailty (75%, N=9), and those aged 85+ years (58%, N=7). Notably, while 92% of the respondents identify people aged 75–84 as users, only 75% see them as beneficiaries. This suggests that one of the highest user groups might not always benefit from digital technology offered by social care services. The comments offered by respondents explained this as follows.

> "Technology has the capacity to increase independence for older people, prevent or delay the need for care and enhance quality of life. However, there remains a stigma attached to prescription of social care technology within some elements of the Adult Social Care workforce, who consider it "robo-care" and "not caring "" (Participant 14, female, age 56, Oxfordshire County Council).

The priorities for TECS among TECS staff were to increase the independence (92%, N=11), quality of life (75%, N=9), and delaying/reducing the need for care (75%, N=9) of older people. Second, reducing the costs and increasing efficiencies in care delivery (75%, N=9) and relieving the pressure on family caregivers (58%, N=7) and social care services (50%, N=6). TEC is embedded primarily in these services: reablement or short-term support (100%, N=12), activity monitoring to assess independence (92%, N=11), fall intervention (83%, N=10), support following hospital discharge (83%, N=10), and telemonitoring/telehealth (42%, N=5). TEC is available to individuals eligible for and funded by the LA or adult social care (100%, N=12) as part of a short-term offer, such as to support reablement (92%, N=11), and to those who self-fund their care (83%, N=10).

The main indicators of TEC success were enhancing the quality of life of older people (92%, N=11), creating a safer home environment (75%, N=9), improving independence (67%, N=8), enhancing the quality of life for family caregivers (67%, N=8), and improving or stabilizing the health of older people (58%, N=7). When asked what TEC is the most effective, the respondents indicated that more traditional technology, such as telecare, is essential for enabling vulnerable adults to live safely and independently at home, thus forming a key part of care planning. For example, fall detectors linked to telecare and emergency response services have been successfully integrated into routine care, reducing risks, such as long lies after a fall. Simpler devices such as emergency buttons are praised for their ease of use, especially for individuals with memory or dexterity issues. However, most responses indicate that newer technology (e.g., commercial technology, medication optimization systems, GPS trackers, and activity monitoring devices) has the potential to generate more benefits and success as long as devices are used regularly (and not forgotten about).

The main barriers to TEC adoption highlighted in the e-Delphi survey were lack of knowledge or skill among LA staff (75%, N=9), older people's awareness of the technology (67%, N=8), support for clients (67%, N=8), resources to scale-up technology (67%, N=8), and personnel to install the technology effectively (42%, N=5). Respondents mostly agreed that TEC offers value for money by reducing care needs and improving system efficiency, especially when it is well supported and implemented effectively. However, concerns have been raised about obsolete technology, unreliable providers, and difficulty measuring impact due to limited trial data and anecdotal evidence. Additional comments emphasized the importance of bespoke support teams, cultural acceptance of technologies in care, and the need for careful monitoring to avoid unintended negative outcomes for service users.

Survey two: reaching consensus

TEC Offerings

All respondents (100%) agreed that the TEC options selected in the first survey aligned well with their products, services, or current offers. They also aligned well with what they hoped to provide in the future, which suggests that respondents agreed on the topic. Consequently, Telecare, GPS, community pendant monitoring, fall detection and protection, and general household aids are the main TEC offered by LAs; however, some LAs also offer additional TEC on a smaller scale. The qualitative comments indicate that 'Digital Inclusion with one-to-one support is a prominent element of support which is not reflected above' (Participant 4, female, age 39, Middlesbrough Council). Furthermore, a respondent commented that "commercial devices have been offered in the past through specifically funded projects but are not a core part of our delivery"' (Participant 6, male, age 50, Middlesbrough Council).

When asked how TEC, especially emerging technologies, alter the fundamentals of care work, none selected 'not at all,' 13% (N=1) selected 'only a little,' 38% (N=3) selected 'to some extent' and 'rather a lot,' and 13% (N=1) selected 'very much.' The comments on this question highlight the potential of technology to enhance social care by supporting independence, improving safety, and reducing care workloads when implemented effectively. However, challenges include improper deployment, lack of integration, and missed opportunities for social workers, which undermine its benefits. Respondents emphasized that technology should complement safety and cost-effectiveness rather than replace hands-on care. Emerging technologies, such as AI, wearable devices, and telehealth, promise to improve outcomes, enable preventive care, and empower users through autonomy and data-driven decision making. However, barriers, such as late adoption, stigma, and financial concerns, limit their uptake. Better understanding, training, and integration could maximize the potential of these tools, shifting care from reactive to preventive, and creating space for social aspects of care to be prioritized.

The Beneficiaries of TEC

There was a 75% (N=6) agreement on who benefits most from TEC (those aged 75 to 84, people with dementia, those aged 65 to 74, people with frailty, and those aged 85+). While older people are widely recognized as significant beneficiaries, 25% (N=2) of respondents were concerned that those with sensory impairments, such as sight and hearing loss, should be included. Technology's potential to empower people with sensory impairments through tools such as screen readers, smart navigation, and magnification is seen as substantial, but underrepresented in the results.

> "I feel that people with sight loss are extremely reliant on technology in the modern world and technology gives them a great deal of empowerment…I think the % on here is far too low." (Participant 6, male, age 50, Middlesbrough Council).

The qualitative responses suggest that people living with dementia benefit the most from TEC because of the extensive range of technology specifically developed to meet their unique and varied needs. The slow progression of the condition often motivates individuals and caregivers to use these tools to extend their independence. Memory clocks, medication reminders, and cognitive stimulation applications can address daily challenges and reduce isolation. Furthermore, because there are "more services supporting dementia, people are less likely to 'slip through the net,"' (Participant 4, female, age 39, Middlesbrough Council). There is also greater accessibility and representation in care provisions for this group, enhancing TEC's effectiveness.

Respondents reported that family caregivers do not benefit as much from TEC due to several factors, including "limited tech offered to this cohort, and it is also not clear how they can request or access it' (Participant 9, female, age 38, Oxfordshire County Council). While caregivers feel more secure knowing that their loved ones are supported, the primary benefits are directed toward the care recipient, with caregivers experiencing only secondary benefits. Managing the setup, maintenance, and potential technical issues can add stress and hidden costs such as batteries or billing errors. Additionally,

Table 4. Top 5 selected options for Q1, Q2, Q3, Q4, Q5, Q7, and Q9. Summary and frequency percentages for responses to ranked choices in e-Delphi survey.

Question	Choice one	Choice two	Choice three	Choice four	Choice five
Current TEC offerings	Telecare monitoring services (100%, N=12)	GPS monitoring (100%, N=12)	Community pendant and related monitoring services (92%, N=11)	Falls detection and prevention (83%, N=10)	General household aids and adaptations for activities of daily living (83%, N=10)
Who are TEC users	Older people aged 75 to 84 (92%, N=11)	People living with dementia (92%, N=11)	Older people aged 65 to 74 (83%, N=10)	People with frailty (75%, N=9)	Older people aged 85+ (58%, N=7)
Who benefits from TEC	People living with dementia (92%, N=11)	Older people aged 65 to 74 (83%, N=10)	Older people aged 75 to 84 (75%, N=9)	People with frailty (75%, N=9)	Older people aged 85+ (58%, N=7)
TEC service priorities	To increase the independence of older people (92%, N=11)	To enhance quality of life for people with care and support needs (75%, N=9)	Delaying and reducing the need for care and support (75%, N=9)	To reduce costs/ increase efficiencies in care delivery (75%, N=9)	To relieve the pressure on family caregivers (58%, N=7)
Primary TEC services	Reablement services/short-term support (100%, N=12)	Activity monitoring to assess independence (92%, N=11)	Support following hospital discharge (83%, N=10)	Falls intervention services (83%, N=10)	Telemonitoring/telehealth services (42%, N=5)
Barriers to TEC	Lack of knowledge or skill among LA staff (75%, N=9)	Older people's awareness of the technology (67%, N=8)	A lack of support for clients on how to use the technology (67%, N=8)	Lack of money/ resources to scale-up the technology (67%, N=8)	Lack of personnel to effectively install the technology (42%, N=5)
TEC success indicators	An enhanced quality of life of the older person (92%, N=11)	Older people feel safe within their own homes (75%, N=9)	An enhanced quality of life to the family caregiver (67%, N=8)	An improved independence of the older person (67%, N=8)	Improvements/stability in the health of the older person (58%, N=7)

technology may generate data requiring caregiver intervention, which can be overwhelming rather than supportive. Caregivers might also be unaware of the available technology or misconceive that TEC is only applicable to older people. Moreover, TEC cannot replace the need for hands-on care that many caregivers still provide.

To improve the benefits to family caregivers, all respondents agreed and reached a consensus on the following: understanding their needs (100%, N=8), offering training and support (100%, N=8), ensuring the privacy and security of the device and data (100%, N=8), improving the affordability and accessibility of the TEC (100%, N=8), and involvement of family caregivers in decision-making (e.g., inclusive design and PPI groups; 100%, N=8).

Main priorities of TEC services

There is an 88% (N=8) agreement that the priorities of TEC reported in survey one represents the priorities of LAs, and they are ranked as follows:

1) Increase the independence of older people
2) enhance quality of life
3) delay and reduce the need for care
4) reduce costs/increase efficiencies in care delivery
5) relieve the pressure on family caregivers.

The responses highlight that meeting the priorities of TEC involves a person-centred approach, where individual assessments

and regular reviews are key to ensuring that TEC effectively supports users. LAs, such as Middlesbrough, prioritize promoting independence, enhancing safety, and delaying the need for more intensive care by offering tailored solutions, such as pendants, memory aids, and assistive technology. However, challenges arise when people are reluctant to engage with services early, which can lead to crises that complicate the implementation. Success is monitored through feedback from users and family members as well as by tracking key performance indicators, such as cost savings and improved outcomes. Financial pressure sometimes limits the scope of TEC, but efforts to reduce care packages and provide family caregivers with respite through TEC are underway. Additionally, education, training, and exploration of emerging technologies such as AI-driven analytics are important for improving service delivery and understanding the impact of TEC.

Barriers to TECS

Most respondents (88%, N=7) agreed that barriers to TECS identified in the survey aligned well with the challenges faced in their LAs: 1) lack of skill among LA staff, 2) older people's awareness of the technology, 3) lack of technical support for older people, and 4) lack of money and resources to scale up the technology. Other barriers that are not reflected include resistance to adopting TEC among older people, older people's poor understanding of TEC's practical benefits, and the cultural shift required among staff to prioritize TEC in service delivery. Further issues include poor rural connectivity and technological limitations in areas with inadequate Wi-Fi networks. Additionally, issues such as fragmented systems, where devices require different dashboards, are considered obstacles to seamless integration.

When asked how to upskill the LA workforce, respondents' preference was to give LA staff members hands-on experience (75%), embed digital skills into their induction process (75%), and provide face-to-face training (50%; see Table 5). The qualitative comments mentioned that some LAs already provide training, including early and effective intervention, emphasizing the importance of integrating training into formal processes such as induction, supervision, and performance reviews to ensure accountability. While various training modalities are offered, including face-to-face, online learning, and hands-on demonstrations, the overarching aim is to address the social care teams' lack of awareness" (Participant 6, male, age 50, Middlesbrough Council) regarding available technology and its potential to shift from reactive to proactive care. Initiatives include peer-to-peer support, practical sessions displaying technology during assessments, and creating TEC demo sites and eLearning modules, which are now part of the induction process.

To raise awareness of TEC, information, and referrals from primary care providers (e.g., GPs: 75%) and third-sector organizations (50%) are the best way (see Table 5). Comments relating to this question suggest that some LAs already offer printed materials, an online presence, and established services, such as Hospital to Home, with solid connections to local hospitals. Others have suggested that support for older people could be enhanced by meeting them in community settings where they feel comfortable. Community engagement is therefore critical, as older people often rely on word-of-mouth rather than digital tools, and direct discussions can uncover needs beyond simple referrals. Standardizing support across LA boundaries and ensuring that trusted, familiar organizations share information and make referrals enhance trust and accessibility. Practical

Table 5. WP4 e-delphi exercise top 3 choices for overcoming barriers to TEC adoption. Summary and frequency percentages to ranked choices for barriers to TEC adoption.

Question	Choice one	Choice two	Choice three
How to upskill the LA workforce	Give hands on experience (75%, N=6)	Embedding digital skills into the induction process (75%, N=6)	Provide face-to-face training (50%, N=4)
How to raise awareness of TEC for older people	Information/referral from primary care providers/GP referral (75%, N=6)	Information/referral from third sector organisations (50%, N=4)	Printed information about services (38%, N=3) Information/referral through non social care LA service (38%, N=3)
How to provide technical support for older people using TEC	Dedicated TEC staff to provide technical support (75%, N=6)	Incorporating technical support for TEC users among existing staff (63%, N=5).	Enhanced training for TEC staff to assist with technical support (50%, N=4) Increased technical knowledge among TEC users/carers (50%, N=4)
How to resolve resource related issues when providing TEC	Greater evidence about the effectiveness of TEC (88%, N=7)	Greater commissioning guidance related to TEC (75%, N=6)	Ringfenced increases to TEC service budgets (63%, N=5) New iterations of technologies that are more cost-effective (63%, N=5)

solutions, such as showrooms or living labs where individuals can test technology, would help build confidence.

To provide technical support, the LAs agree that the best solution is to employ dedicated TEC support staff (75%) and incorporate technical support for TEC users among the existing staff (63%; see Table 5). The qualitative comments mentioned that ensuring effective aftercare is vital for supporting older people with technology as it evolves. One respondent mentions that "older people need to feel they do not have the sole burden of resolving issues" (Participant 4, female, age 39, Middlesbrough Council). Reliable infrastructure, like a stable Internet, reduces problems, as "sometimes the problem is not the tech but the infrastructure underneath" (Participant 10, female, age 39, Oxfordshire County Council). There must be dedicated TEC technicians who provide installation, training, and ongoing help until users feel confident. A multilevel approach is essential, with specialist staff to support advanced technical issues, upskilled frontline workers, informed carers offering natural support, and technology mentors. Accessible resources, including downloadable guides and online repositories, can support staff and residents in adapting and using new technologies.

To resolve resource-related issues, respondents think that the best solutions are to provide greater evidence about the effectiveness of TEC (88%), have greater commissioning guidance related to TEC (75%), ringfenced increases in TEC service budgets (63%), and new iterations of technologies that are more cost-effective (63%; see Table 5). The comments outline that the affordability and effectiveness of TEC remain significant challenges, especially for people on state pensions or with limited incomes. One respondent noted, "TEC is expensive and new and is risky to invest in" (Participant 7, female, age 27, North Somerset Council), particularly given limited budgets and the risk of investing in companies that may fail. Evidence-based research on TEC's long-term impact of TEC, such as its preventative benefits and cost savings for health and social care, could guide better procurement and implementation. However, such studies must be concise and digestible. Private sector solutions such as Alexa or Google Home offer potential, but often bundle unnecessary features, raising costs. Over time, as smart home technology becomes more standard and costs decrease, it may become easier to integrate health-oriented services or develop lower-cost leasing models for users, thus enabling broader access.

Discussion

The findings from the e-Delphi exercise highlight the acceptance of traditional TECS by LAs, including telecare and fall prevention, mostly benefitting older people aged 65–84 years and those living with dementia. Family caregivers benefit the least (mostly indirectly) because TEC are not generally designed for them and are difficult to access. These technologies are used in services such as reablement, hospital-to-home monitoring, and activity monitoring. While all LAs agree on what TEC is currently offered, newer technologies are sometimes provided on a smaller scale but face challenges in terms of consistent use, integration, and scale-up. TEC is used to promote independence, enhance the quality of life of older people, delay further care needs, and improve care efficiency. However, barriers still emerge, including gaps in the digital skills of LA workforce, limited user awareness and support, and resource constraints.

These findings indicate several key recommendations for TEC to move forward. First, social care services should adopt a more inclusive and person-centred approach by expanding TEC offerings to benefit all groups, including those with sensory impairments. In doing so, family caregivers should be involved in the design and decision-making process to ensure that users and caregivers fully benefit from the technology. LAs should invest in support staff who specialize in installation and maintenance, provide accessible resources, and ensure that technical issues do not fall solely on service users. Second, LAs should upskill their employees by including digital training in inductions, giving them hands-on experiences, and ensuring continuous support. Third, raising awareness among older people can be achieved by communicating through trusted channels such as GPs, third-sector organizations, and community engagement. Finally, to scale up services and ensure cost efficiency, there should be more academic research into the effectiveness of TEC and newer, more cost-effective iterations of TEC.

Work package 5 – Methodological and theoretical frameworks and application development

Introduction

WP5 brought project activities together via consensus workshops with the three co-production groups, a consensus workshop with local authority and ICB staff members, and a consensus workshop exploring factors influencing the economic evaluation and assessment of social care TECS. This section summarizes the findings of the consensus activities undertaken in the project, before summarizing the main outputs from the project, in the form of two applications to NIHR HTA and RPSC funding competitions, which have arisen from the project. The section concludes with a brief discussion of the overall findings, recommendations, and limitations of the project.

Consensus workshops

Two consensus workshops were held, each of which took the form of an online focus group. One group was held with TECS staff participating in LA, and a second focus group with experts in health economic assessment to identify an appropriate evaluation framework for TECS. We set out to explore what might constitute the key research and economic questions related to the research priorities that had been identified in previous co-production workshops and consensus groups, and to consider appropriate methods of addressing these questions.

We aimed to recruit up to six health economists working in UK universities who were interested in technology-enabled social care research. We sent an invitation to researchers on the mailing list of the Social Care Economics Network (SCENE) via the network coordinator and distributed the email via DIALOGUE co-investigators' networks, asking interested researchers to contact the leads. In both focus groups, PowerPoint

slides were presented to participants, which summarized results from previous work packages, and used these topics to provide a focused discussion.

The focus groups lasted between 1 h and 1 h 45 minutes and were held online using the Teams platform. The groups were recorded and transcribed. A thank-you payment voucher of £25 was offered to participants. Using a framework approach, transcripts were first coded by topic area and methodological approaches were suggested. The themes were narratively summarized.

A focus group with LA TEC teams was included in the initial ethical review of the project at the University of Stirling [GUEP 2024 18182 13299]. A further review of the economic evaluation consensus workshops was conducted by the LSE Ethics Committee and approved 9th January 9, 2025.

Six TECS staff members across four local authorities participated in the LA focus group in January 2025. Four health economists working in UK universities participated in the economic evaluation focus group held in early February 2025.

Consensus workshop results

Discussions in consensus workshops ranged widely. The participants described their previous research and practice experiences working on their respective TEC services. Not all topic areas elicited comments; the focus of discussions was mostly on costs of technology, trust in TECS, and digital inclusion and exclusion, and to a lesser extent everyday technologies and consumer markets and infrastructure, design, and environment. In the LA/ICB consensus workshop, themes that emerged included factors influencing the implementation and integration of services across sectors (ICB, NHS trusts, and LAs), barriers to the uptake of technologies among both professionals and older people, evaluating and demonstrating evidence of impact, commissioning and procurement challenges, and strategic and organizational challenges to technology adoption. In the economic consensus workshop, themes emerged that crosscut the topic areas: time horizons and time frames of evaluations, evaluation perspective, relevance of evaluation aims and outcomes, data collection challenges, application of economic theory, and reflecting complexity in evaluations.

Participants in both workshops argued for employing methods that went beyond standard trial-based approaches to evaluate the costs of TECS and examine issues of digital inclusion and exclusion. Economists believe that economic theory could be used to understand the issues of trust and consumer markets for technologies. Discrete Choice Experiments and contingent valuation approaches were suggested as a means of evaluating TECS from the consumer perspective, participants attaching importance to affordability and willingness to pay for these technologies, and preferences for specific aspects of technologies. Equally, the economic evaluation group was concerned with social care commissioners' perspectives and identified ways in which these decision-makers' priorities differed from their healthcare counterparts. These findings were also evident from accounts from LA staff members, who highlighted similar tensions between enhancing clients' independence and quality of life, and meeting financial imperatives for services. For instance, commissioners might focus on the immediate affordability of making TECS investments, or where cost savings are accrued, rather than long-term or whole-system changes.

Consensus workshops have identified key gaps that pose structural or practical barriers to ongoing TECS development. A lack of confidence and skills on the part of both clients, but also wider LA staff, was identified as an ongoing barrier to the effective use of TECS. Knowledge and information gaps, specifically on the availability of technologies and services, were felt to hamper decision-making in terms of service delivery and future service development. The evidence base for TECS was partial, limited to small-scale pilot projects, and a lack of clear evidence generated through evaluation was noted. Building tools for the evaluation of LA TECS was highlighted as a need for both consensus workshops. A lack of standardized evaluation tools that would support LAs in conducting local evaluations of their services or enable cross-service comparisons across LA providers was noted as a gap in the LA workshop, which would enhance future development and scaling up of the TECS. It was striking that participants saw mixed methods, particularly Discrete Choice Experiment approaches, as appropriate for evaluating the costs and outcomes of the TECS interventions. They suggested qualitative methods for investigating the complex production of TECS, namely participatory research with staff delivering the intervention and realist evaluation approaches. Another route for evaluating TECS is through quasi-experimental designs using routine data collected through digital records and apps.

Discussion and conclusion

Summary of key findings

As a project development grant, the primary goal of DIALOGUE was to identify the scope for future research related to the delivery of TECS in social care, in order to lay the groundwork for future applications for research funding. The goal of DIALOGUE is to start the process of developing a wider research agenda assisting the generation of real-world and practical and usable evidence in relation to TECS, which can support social care services in commissioning, delivering, and evaluating future TECS services. DIALOGUE collected evidence from the literature and from participating local authorities regarding current practices in the delivery of TECS and key gaps. The project summarized much of the current knowledge regarding factors influencing current TECS services from across service users and, using co-production with older social care service users, highlights key priorities for consideration in future research within the TECS field.

The project highlighted several intractable issues that continue to play a role in influence the development of TECS in social care. Many of the issues highlighted across the stakeholder groups engaged in DIALOGUE (older social care service users, carers, LA staff and commissioners, and academic experts in the sector) appear to be perennial issues within TECS research. From the perspective of service users, these included building

awareness of TECS and deployed technologies and their potential, engendering a sense of trust in technologies and services being delivered, and providing clear information and signposting pathways through which older people can access technologies, which can support older people to use technologies in person-centred ways appropriate to their own life circumstances. For LA providers, issues arising in the project included the need for guidance and support for the commissioning of TECS, providing an evidence base that reflects the local circumstances in which TECS may be provided by an LA but also allows for meaningful cross-service comparisons. In addition, ensuring adequate training in TECS, ranging from practical knowledge about what technologies are available to how to assess and provide technologies in person-centred ways that will enhance ongoing adoption and usage, are highlighted as ongoing areas for knowledge exchange and development. Given the importance of efficiency and cost effectiveness associated drivers within social care policy and commissioning, providing technologies in person-centred ways may lead to services achieving expected cost savings and efficiency improvements; however, modes of delivery and evaluation models need to be sensitive to such service models. Building opportunities for greater flexibility within services to support the delivery of technologies in person-centred ways should be considered in any future research agenda for TECS.

Our review of the literature pertaining to the delivery of TECS, specifically within social care contexts, highlighted similar findings. Preconditions for successful TECS adoption in social care relied on several well-recognized factors in relation to technology and its design (e.g., being intuitive to use, adaptable, and personalisable according to changing needs within and across social care clients). Assessment and delivery of TECS should be comprehensive and person-centred, for example, including ongoing follow-up and adaptation as service user needs change. Considering TECS as an ongoing project requiring personalization and adaptation, rather than being 'dropped in' as a one size fits all solution has been long recognized within the research literature, and among staff delivering such services, but continues to be under-considered within commissioning policy, or decision making about technology adoption and deployment. There are several examples of good practices in terms of delivering personalisable TEC solutions in social care. Many of the continuing gaps highlighted in this research, such as signposting to technologies for service users and training in person-centred approaches to technology deployment, suggest that this approach is not yet recognized at the core of ongoing policy making and practice ethos in relation to TECS.

Limitations

This study had several limitations. As a project development grant, the primary goal and outcome of the project was to generate an NIHR HTA funding application, rather than specifically to generate new knowledge regarding TECS service delivery. As a time-limited application development grant, our findings are based on relatively small-scale engagement with services over a shorter period when compared to a larger empirical research project, including greater engagement with a wider range of stakeholders. This means that the findings should be approached with caution and should be validated in a larger study.

A further limitation related to the timing of the funding application for this project development grant was required for submission. The stage one application call was introduced after only a brief period of initial funding (four months after project onset). This meant that project activities that were originally planned to be conducted during the earlier stages of the project were postponed until later in the project to allow for grant development activities. This had the effect of limiting work with partners that could be conducted to generate the stage 1 funding application. Specifically, DIALOGUE was limited in the preparatory work that could be undertaken to ascertain and design an effective randomized controlled trial.

Project outputs & future work

The primary output from this project was a stage 1 Application to NIHR HTA Social Care technologies call in June 2024. A Stage 1 application was submitted, which proposed a pilot randomized controlled trial of post hospital discharge and reablement services using digital technologies within social care. The proposed RCT would scope the feasibility of conducting a large-scale RCT across multiple local authority sites, given the differences in the range of settings, service models, and deployed technologies within services. The RCT also included a nested process evaluation, with the goal of exploring factors influencing the implementation, adoption, scale-up, spread, and sustainability of post hospital discharge services delivered within social care. This application did not proceed beyond Stage 1, with peer review feedback highlighting issues with differences between the proposed services to be included in the pilot trial. The process of submitting this application demonstrated the difficulty of applying traditional health-related RCT methods to assess complex, highly variable service models, such as those delivered within social care. Ongoing work within the team will look again at the possibility of developing a pilot RCT, given the subsequent project activities undertaken since the original submission.

A further submission to NIHR was made to Stage 1 of the NIHR Research Programme for Social Care's Highlight Notice programme in October 2024. This project further developed the process evaluation adopted in the above application to explore in greater detail the factors that influenced the commissioning, implementation, adoption, scale-up, spread, and sustainability of digital post hospital discharge services delivered in social care. This project application proposes to use the NASSS (non-adoption, abandonment, scale-up, spread, and sustainability) framework (Greenhalgh *et al.*, 2017; Greenhalgh *et al.*, 2018) to conduct a four-year evaluation for the deployment and subsequent development of three different post hospital discharge services located in social care and using digital technologies to identify what works to support ongoing service development and delivery across social care. At the time of publication, this application was successful, and the project will begin in April 2026.

Further planned outputs from this project include academic papers reporting findings focusing on the following work packages: WP1 findings from the co-production groups; WP2, rapid review of evidence for TECS delivery in social care; WP3-WP5 process evaluation, e-Delphi exercise, and consensus workshops. The papers will be written and submitted for publication in 2025. Further outputs will include supporting information and resources to support local authorities in implementing TECS to be published on the DIALOGUE project website (www.dialogue-project.org).

Data availability statement

Research data was collected from participants in the research within work packages 3 and 4, and includes qualitative data from interviews with local authority staff members (WP3), qualitative data collected from consensus workshops (WP4) and quantitative data in the form of responses to an online e-Delphi survey (WP4). Regarding wider data sharing, qualitative data collected in this project is not being made available for wider sharing. This is due to limitations in the raw qualitative and quantitative data, based on a small sample size and in-depth qualitative engagement with a limited number of participating social care staff within the three local authorities identified in this report. This data cannot be fully de-identified to ensure full anonymity of participants, without potential for breaching on confidentiality and anonymity if the wide qualitative data collected in this project is made available for sharing via a data repository. Data shared in this paper are anonymised as far as possible to ensure participants in local authorities cannot be identified. Qualitative data collected from participants involved collecting data from individuals in specialised teams and who were working in geographically defined areas, meaning that raw data can potentially be identified even after anonymisation. Only data removing identifying information (e.g. employing local authorities) will be communicated in further detail in future academic publications.

Data is not currently publicly shared due to the small sample sizes of individuals and sensitive nature of the interviews, which impacts on the confidentiality and anonymity of research data. Among social care professionals, small sample sizes combined with the pre-identified local authority participation means that participants in the research are potentially identifiable within the project research data (interview transcripts). Transcripts of workshops were not routinely recorded as research data so are not available for sharing. Selections of anonymised qualitative data can be made available for sharing by contacting the project Principal Investigator. Restrictions to overall data sharing were agreed as part of ethics submissions processes for this project.

Access to qualitative material generated in this study can be requested via contacting the Principal Investigator (grant.gibson@stir.ac.uk). Anonymised excerpts and thematic data may be made available to qualified researchers upon reasonable request.

To request access, researchers should:

- Provide a proposal including research aims and methodology and outlining intended use of data.
- Sign a data access agreement that includes terms on confidentiality, data protection, and appropriate use.
- Where necessary, obtain approval from their Research Ethics Committee or demonstrate equivalent ethical oversight prior to any application for data sharing.

Access to anonymised qualitative data will be subject to the following conditions:

- The proposed use is compatible with the original ethical approval granted for the study. If necessary, the researcher should seek additional ethical approval from their own institution.
- Only anonymised data will be shared. Direct quotes or excerpts that risk re-identification will either be redacted or withheld. No personal identifiers (names, locations, institutions) will be included.
- The data must only be used for the purposes specified in the access request. General or open-ended use will not be permitted.
- Access is restricted researchers affiliated with an academic or research institution. Proof of affiliation (e.g., institutional email address or letter of support) may be required.
- The researcher must commit to storing and handling the data securely, in line with their institutional policies and GDPR requirements.
- Researchers must sign a Data Access Agreement outlining permitted usage, confidentiality requirements and conditions for data retention, storage, and deletion.

The data must not be used for commercial purposes unless explicitly approved.

Copies of the WP2 scoping review reporting guidelines checklist, and WP3 qualitative interview questionnaire can be accessed via the following DOI https://doi.org/10.6084/m9.figshare.29996305.v1 Data is shared via CC-BY 4.0

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