Protocol v4 08/01/2021

New and emerging technology for adult social care: the example of home sensors with artificial intelligence technology

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Summary

Background

New and emerging technology, such as home sensors that use artificial intelligence (AI), have been identified as promising in addressing adult social care challenges (e.g. increasing needs for social care alongside workforce supply challenges), particularly in the context of Covid-19. However, there is a lack of evidence to support their widespread use, and to support local authorities and care providers making decisions around the implementation of these technologies. Overall, the evidence-base is sparse, methodological limitations of available studies are common (for instance, research showing a lack of understanding of existing practices and in local authorities), and there is a focus on health rather than social care outcomes. The research team, through scoping work, identified gaps in existing knowledge, which include: the criteria on which directors of local authorities and care providers base their decisions about the adoption and implementation of new and emerging technologies, and how these may be improved; how new and emerging technologies are currently used to deliver public services; information to help caregivers select the most suitable technologies; and the expected or achieved impact of these technologies on service users and caregivers. These gaps have been acknowledged in the literature by commissioners of services, who have shown support for this research proposal (through online project design groups) and expressed concern how to implement technology alongside existing systems of care and the potential impact on future service use. Greater knowledge in this area could help local authorities as commissioners and providers of adult social care in their decision-making about the implementation of new and emerging technologies.

Aims and evaluation questions

This rapid evaluation aims primarily to provide learning to assist commissioners and providers in decision-making about the adoption and commissioning of new and emerging technology, its implementation (e.g. which service users receive the technology in their homes), and early experiences of staff, service users and carers. We will explore this in a diversity of settings/local contexts, keeping the variable of 'type of technology' consistent across five case study sites as we explore new and emerging technologies, and early experiences of these, in a diversity of settings. Although we are interested in new and emerging technology generally, we will collect data from sites that have chosen to use a specific type of technology – home sensors with AI technology, provided by a single technology company.

The name of the technology provider will be kept anonymous to protect the reputation of the provider and because the focus of the study is to create more general learning about new and emerging technologies rather than to explore effectiveness of a single technology. We therefore refer to this technology and the company providing it using the pseudonym 'IndependencePlus'.

The study seeks to answer the following core research questions:

RQ1. How do commissioners and providers decide to adopt new and emerging technology for adult social care? (Decision-making)

RQ2. When stakeholders (local authorities and care providers, staff, service users and carers) start to explore the potential of new and emerging technology, what do they hope it will achieve? (Expectations)

RQ3. What is the process for implementing technological innovation? (Implementation)

RQ4. How is new and emerging technology for adult social care experienced by users, carers and care staff? (Early experiences)

RQ5. What are the broader barriers to and facilitators of the implementation of new and emerging technology in addressing adult social care challenges? (Barriers and facilitators)

RQ6: How has the Covid-19 pandemic influenced responses to the questions above? (Impact of Covid-19)

RQ7: How can the process of implementing new technology be improved? (Making improvements)

Design and methods

To inform our study design, the research team undertook scoping work to better understand new and emerging technologies for social care, with a focus on home sensors with AI technology, and the challenges and lessons learnt from previous research and evaluation efforts. We conducted a rapid scan of relevant evidence, key informant interviews, and selected our case study sites. Scoping work included an exploration of which questions we should ask stakeholders, which themes to consider, and how best to collect the data from care providers and commissioners, service users, carers and care staff.

We will formally invite five case study sites to participate, these being three local authorities and two social care providers. These sites will be invited as they are known to be using IndependencePlus, a technology identified as promising for evaluation through an NIHR-funded prioritisation exercise, the origin of this research study (add ref). The evaluation will be comprised of three work packages (WPs):

- Semi-structured interviews with key stakeholders and documentary review (WP1);
- Analysis and synthesis of data and writing-up of findings (WP2);
- Local workshops with participating local authorities and care providers to share and discuss emerging findings, 'sense-check' our interpretations, and engage in discussions about their next steps in terms of use of technology for adult social care (WP3)

Participants will be decision makers and operational leads (i.e. their colleagues with direct experience of implementing or delivering the exemplar technology) at local authorities and care providers, staff working directly with the technology, and service users and carers who have used IndependencePlus. Primary research will be conducted online, by telephone and if possible, depending on the course of the COVID-19 pandemic, face-to-face.

Plans for service user and public involvement

To ensure that the voices of service users and carers are appropriately captured in our study our protocol has been reviewed by a service user from the BRACE Health and Care Panel[1]. We have also conducted online project design groups with service users and carers from the BRACE Health and Care panel and the University of Birmingham (UoB) Social Work Service User and Carer Contributor group[2], which have fed into the development of our topic guides for interviews. In addition, we plan on having these topic guides reviewed by service users and carers from the two groups and will draw on their expertise and support during our dissemination.

Dissemination and outputs

We anticipate disseminating the findings of this evaluation in a number of ways, including:

- An interim set of presentation slides to share preliminary evaluation findings with case study sites, NIHR HS&DR and the BRACE Steering Group and Health and Care Panel
- Tailored workshops with each of the participating case study sites (WP3)
- A short summary report in digital format, supported by professionally produced infographics, highlighting the overall findings of the evaluation, which may be of particular interest to local authority commissioners and care providers.
- A final report submitted to the National Institute for Health Research, Health Services and Delivery Research stream (NIHR HS&DR) to be published in the NIHR Journals Library.
- An accessible and appropriate final output for service users and carers, such as an infographic or a short animation.
- Sharing findings more widely on social media platforms, such as Twitter
- Papers published in high quality, peer-reviewed, academic journals
- Oral and/or poster conference presentations
- Disseminating findings through BRACE, UOB and RAND networks, including to key social care/local government national bodies and stakeholders. For example, the Social Care Institute for Excellence, Think Local Act Personal, Carers UK, The British Association of Social Workers, TSA, Directors of Adult Social Services, and The Local Government Association.

Throughout our dissemination activities we will draw on the expertise and assistance of BRACE/UoB/RAND partners, our PPI collaborators, Health and Care panel (particularly members with

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[1] The Health and Care Panel is made up of 50 members (diverse representation from system and organisational leaders; middle and operational clinical and general managers; frontline clinicians and other practitioner groups) who act as a source of advice from the health and care sector, and a sounding board in relation to the choice, design, delivery and dissemination.

[2] The University of Birmingham Social Work Service User and Carer Contributor group is a group of service users and carers from diverse backgrounds and with wide-ranging needs and circumstances who are actively involved in teaching on different programmes within the School of Social Policy at the University. Some members of the group have also participated in previous research activities. For further information on this group please visit https://www.birmingham.ac.uk/schools/social-policy/departments/social-work-social-care/social-work/service-users-carers.aspx

communication/journalist expertise) and steering group members who are involved with the project and the BRACE Centre.

Study timeline

Scoping work was undertaken in 2020 and plans to commence the evaluation earlier in the year were put on hold due to Covid-19. The project will officially start in February 2021 and run for 12 months. There will be some time after this 12-month period for dissemination activities.

Funding

BRACE is funded by the NIHR Health Services and Delivery Research (HS&DR) programme (HSDR16/138/31).

Background and rationale

There is an increasing demand for social care in England and a growing funding gap, with potentially 1.2 million people having unmet care needs in England (House of Commons Health and Social Care and Housing, 2018). Adult social care is characterised by large numbers of unpaid carers and some major workforce issues (e.g. high staff turnover, poor conditions) (House of Commons Health and Social Care and Housing, 2018). Furthermore, the fragility of the social care sector has been exacerbated by the Covid-19 pandemic (Dixon, 2020). This highlights the need for innovation and renders the long-term sustainability of social care a pressing issue in policy and practice (Skills for Care, 2018). In this study, by new and emerging technologies for social care, we are interested in telecare, which is the use of technology for the delivery, or facilitation of delivery, of social care (Wright, 2020). As explained by Wright et al. (2020) in a review of technology for social care in the UK, technologies that are used for telecare include "*sensors, computers, mobile/wearable devices, pendant alarms, smart hubs, and other devices and infrastructure, used to monitor users, generate and analyse data about them, and connect or provide them with care and health services*" (Wright, 2020, pg. 2). There are, however, other technologies for social care are currently part of the landscape of social care in the UK, including Information Communication Technology (ICT) for entertainment and social communication, biomedical support, exercise and rehabilitation, and online platforms for the organisations of the care workforce (Wright, 2020).

Home sensors with AI are an example of new and emerging technologies for telecare and are being used by the local authority and care provider case studies in our evaluation. In this section, we present a brief overview of findings from research about both telecare generally, and home sensors that use AI specifically. However, it is beyond the scope of this protocol to go into great depth on the evidence around telecare; an area with a plethora of published research. New and emerging technologies (such as home sensors with AI technology) alongside existing support packages have the potential to transform health and social care (HM Government, 2017, 2020; Papadopoulos et al., 2020; Skills for Care, 2018; Sriram et al., 2019). The aim of these technologies is to improve user and carer quality of life (rather than exclusively providing reassurance to the user and their caregiver, as with previous generations of assistive technology) (Barrett et al., 2015; Doughty et al., 1996). Home sensors with AI aim to maintain or increase service users' independence by spotting emerging issues early to prevent problems or crises before they arise, generating alerts to caregivers when issues occur, and can also be used to plan care (Daly Lynn et al., 2019; Knapp et al., 2016; The AHSN Network, 2018). Other potential benefits of these technologies include improvements to health and well-being, better personalisation of care, control and choice for users at home or in care homes, and a reduction of costs for health and social care services (HM Government, 2017, 2020). Research supporting the effectiveness of these, however, is mixed. These technologies are not new in social care, yet innovation is leading to more sophisticated devices that use AI and machine learning[3] to identify patterns in users' daily activity, recorded by multiple sensors around a person's home (Skills for Care, 2018).

Two key bodies of research drawn upon in this background section are the Whole Systems Demonstrator (WSD) programme, a large randomised control trial (RCT) launched in 2008 by the Department of Health, and a recent evaluation of home sensors with AI technology (Rostill et al., 2019; Rostill et al., 2018). The WSD programme aimed to provide local health and social care

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[3] Artificial intelligence and machine learning in this context is "…a series of advanced technologies that enable machines to effectively carry out complex tasks that would require intelligence if completed by a human" The AHSN Network. (2018). Accelerating Artificial Intelligence in health and care: results from a state of the nation survey https://wessexahsn.org.uk/img/news/AHSN%20Network%20AI%20Report-1536078823.pdf.

authorities with knowledge on which to base investment decisions, and to demonstrate the cost-effectiveness of technologies for health and social care (Henderson et al., 2014; Henderson et al., 2013; Hendy et al., 2012; Knapp et al., 2016; Wright, 2020). Results from the WSD were mixed and neither telehealth nor telecare were found to be cost effective compared to usual care (Chrysanthaki et al., 2013; Wright, 2020). Barriers to the use and acceptance of telecare by users were identified (e.g. the need for technical competence from users, and fears of threats to identity) (Sanders et al., 2012).

Drawing upon research on the use of home sensors with AI technology, the research team found that some studies report positive findings. For example, a recent evaluation of a technology for people living with dementia, carers and care staff. Overall, the technology was well-accepted by caregivers and service users and it was reported to have the potential to reduce people's need for hospital admission (Rostill et al., 2019; Rostill et al., 2018). However, some service users and carers raised concerns about the reliability and user-friendliness of the technology (Rostill et al., 2019). Through scoping work, the team also learnt more about approaches and methodologies used in previous research on technologies for social care, which has informed the development of this study protocol. For instance, the need to consider users' differing home contexts, living arrangements, and perspectives on technology in this evaluation (Henderson et al., 2014; Henderson et al., 2013).

In July-November 2019, an NIHR-instigated and -funded national prioritisation exercise was held, during which organisations and individuals with knowledge of adult social care and social work identified promising innovations (Walton, 2019). As part of this, a prioritisation workshop using James Lind Alliance principles was held in October with 23 members, including people who use adult social care services and their carers, care staff, academics/ researchers, commissioners and policy makers. Of the 20 innovations shortlisted, a technology that uses home sensors with AI (pseudonym of 'IndependencePlus') was identified at this workshop as being among the top five innovations that should be evaluated. Following this, the research team working on this evaluation undertook scoping work on new and emerging technology for social care (with a focus on home sensors with AI technology), which included a rapid evidence review, interviews with key stakeholders and online project design groups.

Theoretical lens

While there is a growing literature on the impact and effectiveness of new technology in health and social care, Greenhalgh et al (2017) have argued that many previous studies have tended to focus on the short-term adoption of simple innovations by individual adopters and on individual barriers and facilitators, failing to theorise the adoption of new technology (Greenhalgh et al., 2017). In contrast they propose a new framework for theorising and evaluating the adoption/non-adoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and social care technologies (the NASSS framework) (Greenhalgh et al., 2017). This framework (informed by theory and evidence) describes the barriers to successful uptake of assistive technology innovations, and provides a guide to the type of issues that should be considered by commissioners and providers when deciding which technologies to adopt, as well as researchers interested in evaluating the implementation of assistive technologies in health and social care (Greenhalgh et al., 2017). Better able to consider the implementation of complex innovations in complex systems, the framework can help to: 1) inform the design of new technologies; (2) identify technological solutions that (perhaps despite policy or industry enthusiasm) have a limited chance of achieving large-scale, sustained adoption; (3) plan the implementation, scale-up, or rollout of a technology program; and (4) explain and learn from programme failures. In our initial scoping with potential case study sites, this framework offers a theoretically informed, evidence-based and practical approach to structuring our research questions and subsequent analysis. Further details of what is captured by the framework can be found in Box 1Box 1

Box 1. framework proposed by Greenhalgh and colleagues (Greenhalgh et al., 2017)

The framework proposed by Greenhalgh and colleagues (Greenhalgh et al., 2017) incorporates the following influences:

Condition (the nature of the condition or illness of users; comorbidities; sociocultural influences)

Technology (material features; type of data generated; knowledge needed for use; technology supply model)

Value proposition supply-side value (to developer); demand-side value (to patient)

Adopters for staff (role; identity), for users (simple vs. complex input), for carers (availability; nature of input).

Organisation (capacity to innovate – leadership etc.; readiness for technology/ change; nature of adoption/ funding decision; extent of change needed to routines; work needed to implement change)

Wider system (political/ policy; regulatory/ legal; professional; socio-cultural)

Embedding and adaptation over time (scope for adaptation over time; organisational resilience)

Greenhalgh and colleagues recommend that evaluators of assistive technologies for health and social care consider each of these groups of influences on the success of the implementation effort.

Why is research on new and emerging technology for social care important/needed now?

Interest from policy makers, local authorities as commissioners and care providers in developing and using technology for social care makes it a current priority for evaluation (HM Government, 10 June 2019, 2020; Watson et al., 2020). This evaluation will provide learning as to whether, and how, this technology might tackle challenges in adult social care, such as how to cope with an ageing population and social care staffing issues, and help equip decision-makers facing choices about whether and how to use new technology to support people living at home and their carers. Furthermore, there has been increasing awareness of the potential of technology for social care over time (Wright, 2020), with new organisations set up in recent years to facilitate this. For instance, the creation of the NHS new joint organisation for digital, data and technology (NHSX) in 2019 to drive digital facilitation and the Digital Social Care Organisation in 2019 to support and advise the sector on technology (Wright, 2020). The Covid-19 pandemic has accentuated the awareness of the potential of technology to deliver, or facilitate the delivery of social care, by increasing the need for care to be provided remotely (Hutchings, 2020; Wright, 2020).

The Universities of Sheffield and Birmingham, funded by the Economic and Social Research Council (ESRC), are working with a range of partners to research the key components of care that promote well-being and create a more sustainable system of social care for the long-term (Lariviere et al, 2018). Technology is a key feature of this programme of work, with early policy roundtables highlighting the potential role that technology has to play in sustainable social care systems and individual care arrangements. While it cannot replace personal care, technology has the potential to support those with care needs to live independent and active lives, and to assist those providing support. However, in order for technology to be "… *successfully embedded in local care systems"* it needs to be "*based on a persuasive evidence base; useful to those who are caring; and - first and foremost - help achieve the outcomes users desire*" (Lariviere et al, 2018, pg. 1).

Scoping work

To inform our study design, the research team undertook scoping work to better understand new and emerging technologies for social care, with a focus on home sensors with AI technology. We conducted a rapid scan of relevant evidence, key informant interviews, project design groups with stakeholders, and selected our case study sites. Scoping work included an exploration of which questions we should ask stakeholders, which themes to consider, and how best to collect the data from care providers and commissioners, service users, carers and care staff. They also enabled us to explore the challenges and lessons learnt from previous research and evaluation efforts and develop our research questions. This work guided our approach to the work packages that follow this section.

As part of our scoping work, we had some early engagement with the technology provider. Members of our research team met with IndependencePlus, and although they showed early interest in our research, for reasons related to the Covid-19 pandemic they are unable to be involved at this time. This does not pose any problems for our proposed research. Firstly, we do not intend to investigate the effectiveness of a technology they are offering, rather, we are interested in learning about new and emerging technologies generally (using IndependencePlus as an example). Secondly, we do not intend to collect data from the technology provider. Furthermore, we are interested in the experiences of stakeholders that have used the technology, regardless of whether the use has stopped. This means our study success is not dependent on the technology provider continuing to exist in the market; an important consideration given the impact of Covid-19 on businesses. However, if IndependencePlus wanted to contribute with information or reflections over the course of the study, this would be welcomed.

Rapid scan of relevant evidence

As part of our scoping work, we conducted a rapid scan of literature relating to the implementation of new and emerging technology, as well as evidence from research and evaluations of home sensors with AI technology specifically. We did this to clarify the research questions, develop research tools and appropriate analytical frameworks for the study. Google searches and 'snowballing' were used, where sources emerged through looking at references and citations of relevant sources (Felizardo et al., 2016). The findings of this rapid evidence scan were described earlier on in the background section of this protocol (for a summary of key themes and messages, see Table 1).

Table 1. Key themes from the rapid review of relevant evidence

Themes from a rapid review of relevant evidence
Technology not being used to its full potential for social care
Gaps in understanding on use of new and emerging technology for social care
A lack of evidence on expected outcomes of key stakeholders (including commissioners and providers, service users and carers)
Little information to support stakeholders in selecting technology
Importance of service user and carer voices
Predominance of health over social care outcomes
Fast pace of change of the technology market and challenges this poses to the use of technology for social care

Key informant interviews

Alongside the rapid evidence scan, 9 interviews were conducted over several months in 2020 on the phone or online with research experts in the field, and decision makers and operational leads (i.e. staff involved in the implementation of technologies) from local authorities and care providers. Interviewees from local authority commissioners and care providers were selected on the basis that they have used IndependencePlus. Informants with research expertise in this area were also interviewed and were identified through the rapid scan of evidence and through networks established within the research team. Interviews were semi-structured, allowing a flexible approach in the topics covered. The key themes arising from informant interviews are shown in Table 2.

Table 2. Summary of key themes from informant interviews

Key themes and messages from informant interviews
Challenges and potential solutions/learning for conducting research in this area
Potential benefits of technology for social care in terms of planning care
The impact of Covid-19 on recruitment and data collection
Importance of collecting data from service users and carers
Support for the use of a socio-technical approach for our research questions
A need to better understand what service managers want from technology
Implications for workforce and the ways in which staff interact with technology
Ethical and political consequences of using data to make decisions
Importance of living situation (e.g. whether or not a user is living alone)
The need for more research with social rather than health outcomes
Incorporating different stakeholder views in the study design
Limitations of having multiple technologies from different providers in a single evaluation

Online project design groups

The research team held three online project design groups with stakeholders in October 2020. The first was with four local authority commissioners and care providers with experience of using IndependencePlus, specifically, decision makers and operational leads. The second and third online project design groups were held with seven service users and carers (four participants in the first group and three in the second). Attendees were from the BRACE Health and Care Panel and from the University of Birmingham Social Work Service User and Carer Contributor group. To avoid exclusion on the basis of an individual's access to, and proficiency or confidence with technology, individuals were asked if they would prefer to speak over the phone with a member of the research team, rather than attend the design meeting. Furthermore, one carer who was interested in contributing but was unable to attend the dates of the online project design groups was offered an individual interview, which took place on the telephone in October 2020. In these online project design groups for both groups of stakeholders, we asked participants about the type of questions and themes they think we should ask in the evaluation and enquired about the practicalities of collecting data (particularly given the Covid-19 pandemic). This was to help us develop the topic guides for data collection and select appropriate and feasible methods in our evaluation. A summary of the themes and key messages from these online project design groups is shown in Table 3.

Table 3. Key themes and messages from online project design groups

Project design groups with local authorities and care providers	**Project design groups with service users and carers (important themes to consider)**
Importance of a clear understanding of what technology can offer at the outset of adoption	Service user choice and control
What constitutes success and how to measure it is often unclear	Privacy
Unrealistic expectations may drive decision making and negatively impact resource planning	Technical skill and requirements of service users and carers
The importance of the environment/context in which the technology works	Available support
Identifying service user need before selecting which technology to use	Impact on social contact with care workers
The skills required of staff and users are a primary consideration and influence on success	How data is gathered and used
Challenges around understanding what new and emerging technologies can do in a fast-changing market	Accountability/responsibility
Strategies for how best to approach and engage staff, service users and carers in the research	Strategies for supporting the participation of service users and carers

Identification of case study sites

As part of the scoping work for this study, the research team created a list of potential case study sites. These were local authorities and care providers in the UK known to be using IndependencePlus (the technology identified through the NIHR-funded prioritisation exercise as worthy of evaluation). We developed this list through emailing and then speaking on the phone or online with the organisations listed on IndependencePlus' website. We were aware of eight sites using IndependencePlus and had communication with five of these; all of which have provisionally stated an interest and willingness to participate in this study. These are three local authorities and two care providers. Our process of obtaining case study sites was therefore pragmatic, with no selection based on any characteristics other than them using IndependencePlus and being interested in participating. These case study sites, however, cover both local authorities and charities/private care providers, a mix of urban and rural, different service user groups (e.g. older and younger service users and range of mental and physical health conditions). Further details on this can be found in the methodology section (see WP1).

All case study sites will be kept anonymous to guard against reputational risk in situations where local authorities or care providers have experimented with new ways of working and not been able to deliver desired outcomes. During our scoping work sites felt that this was a helpful safeguard which would maximise their ability to share genuine learning whether outcomes were positive or negative.

Gaps in current knowledge

Through our scoping work we identified some gaps in knowledge and problems in the current use of technologies for adult social care. Firstly, technology is not being used to its full potential in social care, and there is a call for more investment in this area (Carers UK, 2012; Charlesworth & Johnson, 2018; HM Government, 2017). Technology, such as home sensors with AI, are not widely used for social care and often fail to be scaled up at a local level, or spread widely, and are not sustained in the long term at a system or organisational level (Greenhalgh et al., 2017). Overall, literature on research and evaluation of technologies for social care, including home sensors with AI technology, are under-developed and limited by methodological issues. Using the WSD programme as an example of these methodological issues, they include uncontrolled interventions (i.e. local authorities implementing a range of technologies in a non-standardised way, without necessarily giving it to those likely to benefit), lack of 'ecological sensitivity', meaning the research lacked an understanding of existing practices in local authorities, and short follow-up periods not likely to be long enough to detect improvement (Woolham et al., 2017). A call has been made for more robust research in this area (Knapp et al., 2016; Skills for Care, 2018).

In addition, the research team found through their scoping work:

- Gaps in understanding of the use of emerging technologies to deliver public services, including for assistive technologies in health and social care (Bemelmans et al., 2012; Daly Lynn et al., 2019; Knapp et al., 2016; Skills for Care, 2018; Sriram et al., 2019; UK Government, 10 June 2019);
- A lack of evidence on the expected or achieved impact of these technologies on service users and caregivers, hindering the wider use of technology in social care (Knapp et al., 2016). This has been acknowledged by commissioners of services, who have expressed a gap in knowledge regarding how best to implement technology alongside existing systems, the potential impact on future service use, the workforce, and costs (Knapp et al., 2016).
- Little validated information to help caregivers select the most suitable technologies (Daly Lynn et al., 2019);
- That service user and caregiver voices are often neglected from research and evaluation (Skills for Care, 2018), despite acknowledgement of the importance of this (Greenhalgh et al., 2015);

- That although there is a clear interaction and overlap between health and social care (Hendy et al., 2012), most literature and empirical research on assistive technology for health and social care focuses on health outcomes (even if the researchers state an interest in examining both).

Our scoping work suggested that these gaps are significant in preventing commissioners and providers from making greater use of new and emerging technology. This enabled us to develop some key questions we plan to address in our study, which include:

- What criteria do decision makers and operational leads in local authorities and care providers use to inform their decisions to implement (or not) new and emerging technologies for social care, and with which service users? How can this process be improved or standardised?
- What learning can be gleaned from recent efforts to implement new and emerging technologies for adult social care, particularly in the context of Covid-19?
- What are the early experiences of service users and carers in terms of the implementation of new and emerging technology in their homes, the usability and benefits/pitfall of this type of technology for social care?

Who is the research aimed at?

Findings will be of interest to local authority commissioners and care providers in the public, private and voluntary sectors, as well as direct users of assistive technology for social care (service users and carers) and front-line care staff and managers. Specifically, adult social care organisations who are considering whether and how to adopt technologies for social care. Although we focus on the implementation of a IndependencePlus to keep the variable of type of technology and provider constant across case study sites, we aim to develop wider learning about the process of decision-making and implementation for new and emerging technologies more generally, which will be of potential benefit to all commissioners and social care providers (beyond those considering this particular technology).

Project plan

Aims

This is not an evaluation of the effectiveness of a specific type of technology. Rather, the type of technology will be a constant throughout the study (IndependencePlus), while we explore the topic of decision making and early experiences of the implementation of new and emerging technologies, in a diversity of settings/local contexts. In the evaluation we will focus on:

- **Decision-making** in the commissioning and provision of new and emerging technologies for adult social care;
- **Expectations/desired outcomes** (e.g. crisis prevention, improving care plans, or redesigning care pathways) of the technology from the perspective of multiple stakeholders (decision makers in local authorities/care providers, staff, service users and carers);
- **Implementation** including practical questions about how it is implemented and by whom;
- **Early experiences** of the implementation of the technology from the perspectives of service users, carers and care staff and how the technology develops as a result, and their views about factors that need to be considered in decision-making;
- **Barriers and facilitators** to the widespread implementation of new and emerging technology for social care.

Research questions

In order to address our aims, the study seeks to answer the following evaluation questions:

RQ1. How do commissioners and care providers decide to adopt new and emerging technology? (Decision-making)

- What factors do commissioners and care providers consider when making decisions about using new and emerging technology for adult social care?
- For instance: whether or not to adopt technology; which model of technology to choose; and which groups of users to provide technology for.

RQ2. When different stakeholders start to explore the potential of new and emerging technology, what do they hope it will achieve? (Expectations/desired outcomes)

- What are the expectations of the technology on the part of commissioners and providers, care staff, service users and carers?
- What are the desired outcomes, from the perspectives of these stakeholders?
- What are their expectations in terms of potential costs and savings?

RQ3. What is the process for implementing technological innovation? (Implementation)

- What work is involved in the implementation and who does it?
- What changes are required to incumbent practices (e.g. to the way staff work, routines and service users' interactions?)
- Where does the responsibility lie if the technology is not adequately sensitive to prevent or detect a concerning event for the user, such as a fall?
- How are data collected and used?
- How could the process for decisions around implementing new and emerging technologies be improved or adapted?

RQ4. How is new and emerging technology experienced by users, carers and care staff? (Early experiences)

- What benefits and challenges are experienced?
- How does the value proposition of the technology provider compare with the reality of the technology in practice?
- What are the implied expectations and requirements of users, carers and care staff?
- How involved are service users and carers in decision-making about the technology (e.g. how much say they feel they have had, their knowledge and involvement in who accesses the information and how it is used etc).

RQ5. What are the broader barriers to and facilitators of the implementation of new and emerging technology in addressing adult social care challenges? (Barriers and facilitators)

- What are the case study sites' capacity and capability for innovation?
- How much scope is there for adapting and co-evolving the service over time (i.e. working with technology companies to develop the way the technology works)?

RQ6: How has the Covid-19 pandemic influenced responses to the questions above? (Impact of Covid-19)

RQ7: How can the process of implementing new and emerging technology be improved? (Making improvements)

Based on findings across the work packages, we will summarise pitfalls and opportunities, and develop recommendations for commissioners and providers when making decisions about whether or not to implement technologies for social care in their services.

Plans for service user and public involvement

To ensure that the voices of service users and carers are appropriately captured through our methods, and that there is a service user involvement element running through this study starting at the planning stages, this protocol has been reviewed by a service user member of the BRACE health and social care panel. Our stakeholder project design groups were also conducted to meet this aim and were attended by seven service users and carers (plus an additional individual interview with a carer over the phone). At the online project design groups, we sought the perspectives of service users and carers on the research questions and themes that should be explored in the evaluation, and the methods for approaching and collecting data from key stakeholder groups.

The service user and carer project design groups were illuminating and valuable. Based on the themes shown in Table 3, they helped us develop the focus of our research, our research questions, and the topic guides for the interviews (described further in the methodology, WP1). We plan to bring this group together again towards the end of the project to discuss our emerging findings, planned outputs and dissemination. In particular, we plan to work with this group to devise accessible and interesting outputs that can be shared with members of the public. In addition, project findings will be shared and discussed at meetings of the full BRACE health and care panel, which includes eight service user and public members. We will also seek the advice of these panel members in terms of the best ways to communicate findings to service user and public audiences, helping to ensure that dissemination activities have a wide reach and impact.

Research design and methodology

Design

We will undertake an evaluation of new and emerging technology, with the example of IndependencePlus, through data collection and analysis from five case study sites. Here, a case study site is defined as a local authority or care provider that is using IndependencePlus. The research team considered whether to include multiple types of technology for social care, provided by a number of companies. We decided to have just one 'exemplar' technology used consistently across our case studies because through our scoping work, it was evident that by keeping this constant, we will better establish what factors influence local decision-making and early experiences of implementation of new and emerging technologies. This decision was taken in conjunction with potential case study sites on the basis that different companies are constantly developing new technology, and that a helpful focus for this study would be on the underlying decision making and implementation process rather than a direct evaluation of a specific technology. In line with findings from our scoping review and key informant interviews, we will pay particular attention to the local contexts in which IndependencePlus is being implemented, including different user groups, geographical regions and local needs.

We aim to formally invite all five sites (three local authorities and two service providers) to take part. The study, however, would still be viable with a smaller number if current circumstances mean that some can no longer take part. At each case study site we will conduct interviews with key stakeholders (phase I with decision-makers and operational leads, along with a document review; phase II with service users and carers) (WP1); analysis and synthesis of findings from interviews and document review (WP2); and local workshops to articulate these and build on them further (WP3). There will be some further analysis and synthesis using data from WP3, to support the writing of reports and other study outputs. The methods used in each of the evaluation work packages are described below. The Medical Research Council (MRC) recommendations for process evaluations will be used as guidance (Moore et al., 2015). For example, we have selected the most important questions to address the research problem, and will use a combination of research methods most appropriate (Moore et al., 2015).

Methodology

WP1: Interviews with key stakeholders

At each of the five case study sites, we will aim to conduct qualitative semi-structured interviews with two-three decision makers and operational leads (Phase I), five staff with experience of working with IndependencePlus, and five service users or carers (Phase II). This means approximately 10-15 interviews with decision makers and operational leads, 25 with staff, and 25 with service users and carers; 60-65 interviews in total, as shown in Table 4.

Table 4. Number of interviews from each stakeholder group and case study site

Stakeholder groups	**Total number of interviews from each stakeholder group**	**Number from each case study site**
Decision makers and operational leads (phase I)	10-15	2-3
Staff working with IndependencePlus (phase II)	25	5
Service users or carers (phase II)	25	5
	Total from each site:	12-13
	Overall:	60-65

Focus of the interviews

Interviews with key decision-makers and operational leads from the case study sites will focus on how decisions are made about the adoption of new and emerging technologies, the process of implementation, early experiences of its use (including potential costs and savings), and key learning points that could be used by others considering using these technologies (e.g. by guiding decisions and processes). Key decision makers and operational leads we will seek to interview will have a role in the decision making and planning of new and emerging technologies for adult social care. They may be Directors of Adult Social Services (DASSS), executive directors, assistive technology leads, or individuals that lead on other aspects of services but have a key role in planning of technology (e.g. strategic leads, leads for governance and quality assurance and service managers).

In interviews with staff, service users and carers, we are interested in experiences of the implementation process; practical realities of technology use; the extent to which the technology has enabled, improved, or hindered daily activities (with a focus on social care) of services; the extent to which the technology has increased or compromised service user and carer feelings of choice and control; and how this type of technology (or the implementation of it) may be improved. As we have not limited our case study sites by setting or service user group, staff may be healthcare assistants, care workers, social workers, etc., and service users may be anyone needing support with their daily living, and may include older people, people dementia or mental health problems, people with physical disabilities or learning disabilities, and family carers. The study team have experience conducting research with service users with different conditions and needs (e.g. multiple sclerosis, psychosis, dementia) and their carers, and we will ensure our approach is tailored accordingly to ensure participants feel comfortable throughout the interview.

Recruitment and consent for phase I and II interviews

Decision makers and operational leads will be recruited through the links made with case study sites during the scoping work. Interviews will be undertaken between March and November[4]. Following each interview with decision makers and operational leads, we will ask these participants to nominate potentially suitable staff, service users and carers for interviews. Suitable staff, service users and carers are individuals with experience of using the technology, who may be interested in participating. We will ask a local lead to contact all care staff, service users and carers involved in using IndependencePlus, providing initial information and seeking permission of individuals who want to take part to the research team.

Inclusion criteria for service users, carers and staff will include:

- Having had the technology set-up in their home and having attempted to use it (for service users).
- Having had experience of implementation and delivering care through the use of technology (for staff).
- Experience of using the technology for a range of social care needs (i.e. there are no limitations of reasons for using the technology).

There are no limitations as to the level of success of the technology used. We are interested even if the technology was abandoned, as we are keen to learn from wide range of experiences of the use of technology for social care. In addition, there will be no exclusion criteria related to the length of time of use of the technology, so that we can obtain varied experiences. We also will not exclude on

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[4] Please note that this period is longer than may be expected to allow for challenges engaging study sites and recruiting participants for interviews during the Covid-19 pandemic.

the basis of service user group or setting; we specifically aim to explore the potentially broad uses of the technology and these contextual differences will add to our learning.

Decision makers or operational leads that participated in phase I will be asked to approach staff, service users and carers, either by telephone or email, with the aim of recruiting five staff and five service users from each site. They will obtain permission from the potential interviewee for the research team to make contact via email or telephone. Where permission has been granted, a member of the team will call or email potential participants to describe the study and its aims in detail. Information sheets and consent forms will be shared using an online platform such as Qualtrics[5]. If a participant does not have access to a computer or the internet, they will instead be posted a consent form and information sheet with a pre-paid stamp and envelope. Each participant will have returned a consent form prior to commencing the interview and will be given a week to two weeks to decide whether they would like to participate. Prior to commencing the interview, participants will have the opportunity to ask questions about the study and/or wider BRACE related work. It will be made clear that participants can withdraw from the study at any time, without having to give a reason, and will also be given information about how to find out more about the study, or to raise concerns about its conduct.

For the document review, once an interview with a decision maker or operational lead has been completed, we will ask the them whether they can identify any documents (not containing sensitive information) that could be shared with the team, that would help build a picture of the decision-making process, challenges and successes, and other aims specified above in the project plan section.

Topic guides and interview conduct

Interviews with stakeholders from phase I and phase II will be between 45 minutes and 1 hour and will be conducted online using a video conferencing platform such as MS Teams or Zoom, with the option of telephone interviews also offered.

Topic guides will be developed for the interviews, one for decision makers and operation leads, another for staff, and a third for service users and carers. These will be reviewed by a member of the service user involvement groups that were involved in the online project groups. The themes and questions covered in the topic guides will be informed by the scoping work we have conducted, particularly the project design groups, and the rapid evidence review (see Tables 1, 2 and 3). A socio-technical framework for approaching evaluations of technology for health and social care will be used (please see background section on ‘theoretical lens’ for further details). For instance, a framework by Greenhalgh and colleagues that describes considerations such as the service’s capacity for innovation, the expected input/adaptation from care staff and the context for widespread use of the technology (Greenhalgh et al., 2017). This pragmatic framework for evaluating technologies covers non-adoption, abandonment, and challenges to the scale-up, spread, and sustainability (NASSS) of the implementation of assistive technologies.

Co-ordination and communication with case study sites

The team have already begun building relationships with the five case study sites that have expressed an interest in participating, through email and telephone contact with decision makers and operational leads. This will be strengthened by the allocation of a member of the research team to each case study site and the identification of a lead contact at each case study site. We will have regular and clear communication with case study leads and where necessary, others we build

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[5] https://www.qualtrics.com/uk/

networks with (e.g. administrators and care staff). Further details on our approach to communication with case study sites can be found in Table 5 (potential risks and mitigation strategies).

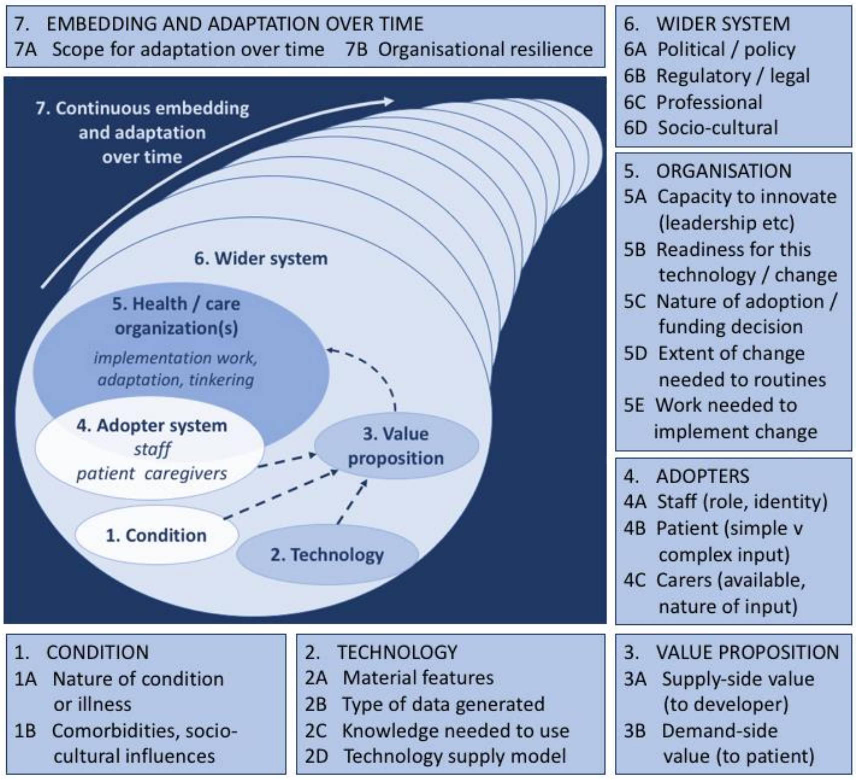
WP2: Analysis, synthesis and writing up

Interviews will be audio-recorded (subject to consent being given) and transcribed verbatim by a professional transcription service. They will be anonymised and kept in compliance with the General Data Protection Regulation (GDPR) 2018 and Data Protection Act 2018. All individuals and organisations involved in the study will be anonymised for all discussions and reporting.

For each case study, our analysis will explore the desired outcomes of new and emerging technologies for social care, how these outcomes are expected to be achieved, and what resources, approaches and activities are supporting the implementation in practice. Thematic analysis of interview transcripts and documents provided by interviewees will be conducted using guidance from Braun and Clarke (2006b). We will iteratively develop a coding frame using early interviews and discussion amongst the study team (Saldaña, 2016). Using Nvivo 12 qualitative analysis software, first the data will be coded at a basic, semantic level. Second, codes will be organised into overarching themes, based on patterns across the interviews. There are likely to be different codes generated from the transcripts of interviews with the three participant 'groups' - decision-makers, staff, service users and carers. The agreed coding framework, therefore, will be developed from across these groups, to ensure these different perspectives are incorporated. Initial coding will be undertaken by two members of the research team (Bridget Roe and Jennifer Bousfield), who will review the first two transcripts from each participant group independently, then meet to agree emerging codes. In an iterative approach, codes will be refined as analysis progresses, through discussion of themes at team meetings, before the final framework is agreed (Braun & Clarke, 2006a).

In interpreting our findings, we will utilise Greenhalgh and colleagues' (2017) NASSS framework, which considers the seven factors set out in Figure 1 (Greenhalgh et al., 2017).

Figure 1. Greenhalgh et al (2017) NASSSS framework to be used for interpreting study findings



WP3: Local workshops with case study sites

We will hold local workshops with each of the five participating case study sites. To agree a final invitation list for these workshops, we will work with case study sites. We envisage that these will include a mix of senior decision-makers, commissioners, providers, front-line care staff, and people using services and their carers, so that discussions are inclusive of all key stakeholders. These local workshops will be held to discuss learning from our research conducted at their site, to gain their feedback and ‘sense check’ our findings. These workshops will also be used to facilitate thinking about the sites’ next steps in terms of the use of new and emerging technologies for adult social care. We therefore hope that as well as providing an opportunity to consolidate learning from the study, the research team can ‘give back’ by providing an opportunity for reflection and further conversation about the use of technology for adult social care in their local area/services. These local workshops will be online for around half a day and will be facilitated by two members of the team. A structured agenda will be used which covers both key findings, our interpretation of emerging themes, and a facilitated discussion of what this might mean for future local service development (collating local lessons and planning future local developments). A key output will be a checklist of considerations, for instance, issues which sites wish they had taken into account before deciding which technology to explore and implementing it, and this will form part of our digital summary report (see ‘expected outputs and plans for dissemination’ below).

Expected outputs and plans for dissemination

Results from this evaluation will be written up and shared widely in a number of formats, both written and verbal. The final report to NIHR will be submitted in January 2022 and published in the NIHR Journals Library (HS&DR Programme), as well as other high-quality, peer-reviewed academic journals.

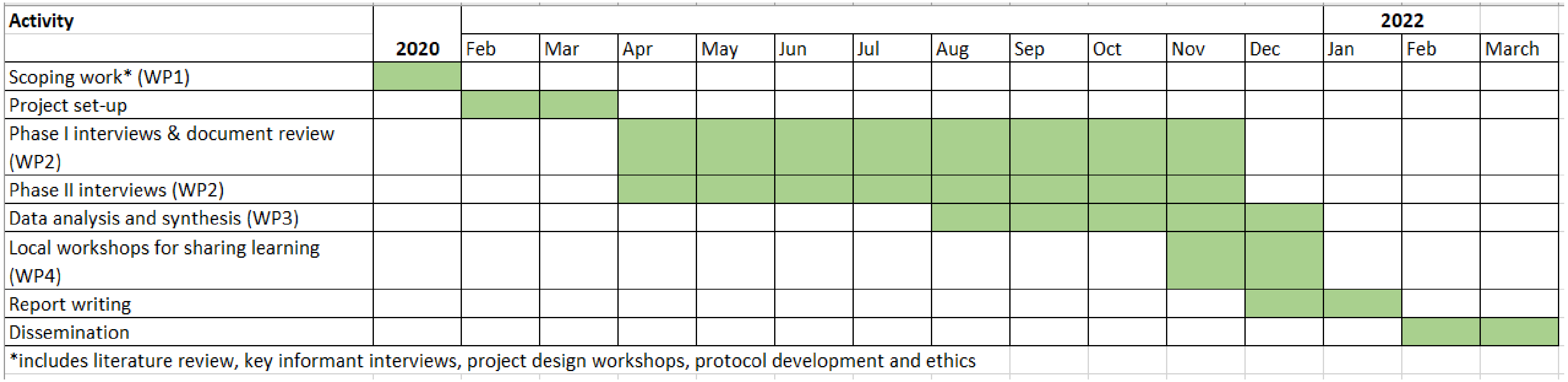
The main routes for dissemination will be:

- A final report submitted to the National Institute for Health Research, Health Services and Delivery Research stream (NIHR HS&DR) to be published in the NIHR Journals Library.
- An interim report, in the form of a set of presentation slides, to share preliminary evaluation findings with case study sites, NIHR HS&DR, the BRACE Steering Group and Health and Care Panel.
- An accessible and appropriate output for service users and carers, such as an infographic or a short animation.
- A short summary report in digital format, supported by professionally produced infographics, highlighting the overarching findings focused on shared learning for the future implementation of new and emerging technology for adult social care. This may be of particular interest to local authority commissioners and care providers, and to others working in social care. It will include a practical checklist for commissioners and providers using technology in the future, to contribute to further service development, and will be included in the NIHR report as an appendix.
- A short reporting document including the local theory of change, to share more widely with key local stakeholders.
- Papers published in high quality, peer-reviewed, academic journals
- Oral and/or poster conference presentations
- Sharing findings more widely on social media platforms, such as Twitter
- Disseminating findings through BRACE, UoB and RAND networks, including to key social care/local government national bodies and stakeholders. For example, the Social Care Institute for Excellence, Think Local Act Personal, Carers UK, The British Association of Social Workers, TSA, Directors of Adult Social Services, and The Local Government Association. We will draw on the expertise and assistance of BRACE/UoB/RAND partners, our PPI collaborators, health and care panel (particularly members with communication/journalist expertise) and steering group members who are involved with the project and the BRACE Centre'.

Project timetable

The study will take place over approximately 12 months (February 2021 to January 2021) with two additional months for dissemination. This is assuming timely access within our case study sites, obtaining necessary ethical and governance approvals, as well as identifying and completing data collection with key stakeholders. Figure 2 shows the overall study timeline and the key milestones for the project and includes the scoping work undertaken prior to the writing of this protocol.

Figure 2. Study timeline and key milestones



Activity												**2022**		
	2020	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March
Scoping work* (WP1)	🟩														
Project set-up		🟩	🟩												
Phase I interviews & document review (WP2)				🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩				
Phase II interviews (WP2)				🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩				
Data analysis and synthesis (WP3)								🟩	🟩	🟩	🟩	🟩			
Local workshops for sharing learning (WP4)											🟩	🟩			
Report writing												🟩	🟩		
Dissemination														🟩	🟩

*includes literature review, key informant interviews, project design workshops, protocol development and ethics

Project management, governance and delivery

Project management and quality assurance

This proposal has been reviewed by Prof Judith Smith (BRACE Director), Dr Jo Ellins (BRACE Deputy Director), Jon Sussex (Chief Health Economist, RAND Europe), and by three independent reviewers: an academic researcher in the field, a member of the BRACE steering group with social care expertise, and a service user/carer member of the BRACE Health and Care panel.

The principal investigator, Prof Jon Glasby (UoB), will be responsible for the overall delivery and quality assurance of this project. Dr Jennifer Bousfield (RAND Europe), with maternity cover by Lucy Hocking (RAND Europe) from April, will be responsible for project management and co-ordination of the study, with input from UoB and RAND Europe team members. Fieldwork will be completed by Dr Jennifer Bousfield, Sarah Parkinson (RAND Europe), Lucy Hocking, and Dr Bridget Roe (UoB), with Dr Denise Tanner (UoB) leading on engagement with service users and carers.

We will apply the following project management principles and processes: ensuring clarity of team members' roles, and the delegation of tasks and reporting duties; internal team meetings and catch-ups; and use of project planning tools (such as a Gantt chart and internal monitoring reports). RAND Europe's approach to project management is guided by its ISO 9001:2015 certification and is seen as fundamental to the successful and timely delivery of the evaluation.

For this particular project, once data collection begins, fortnightly (or more frequently if required) team teleconferences will be held in order to update progress and address any arising issues promptly. The project team will report to the BRACE Executive team, Steering Group, and to NIHR HS&DR as and when required. We describe potential risks and mitigation strategies in Table 5. All reports and other deliverables will be peer reviewed by the BRACE Director (Judith Smith) and a minimum of three people, drawn from the following: academic critical friends (linked with the BRACE collaboration or elsewhere), the BRACE Health and Care Panel, and Steering Group.

Table 5. Potential risks and mitigation strategies

Risk	**Impact**	**Likelihood**	**Mitigation**
Non-engagement from case study sites/ need for postponement of data collection due to Covid-19 and associated increased pressure on stakeholders	Medium	High	Success of this rapid evaluation will depend on the co-operation of case study sites for providing participants to interview. Therefore, there is a risk that we may be delayed in recruiting participants in a timely manner, due to the Covid-19 pandemic. To mitigate this, we: • Have extended the recruitment period to avoid the study team feeling they need to apply an unacceptable pressure on participants in order to meet targets; • Have started (and will continue) to build relationships with, and familiarity with key points of contact at the case study sites; • Have approached the issue with case study sites and discussed the best way of working together, how best to minimise additional workload, and shown our understanding of the sensitivity with which potential participants should be approached; • Will ensure we take a tailored, appropriate, and flexible approach to recruitment that considers the context and situation for each site. In addition, the team will adhere to good practice in developing relationships with potential participants and have a clear and planned strategy for recruitment. Interpersonal skills will be key, particularly when negotiating access to care staff and service users and carers using the technology at the case study sites. The research team will be clear about the objectives of the study, and the time and resources required from participating case study sites. The team will produce detailed and clear, descriptive information sheets to inform potential participants the importance of the evaluation, why we have asked them to take part, their involvement, and associated risks and benefits.
Company providing the software goes into administration	Medium	Low	The study does not require case study sites to be currently using or planning to continue using the exemplar technology (as long as they have prior experience of doing so). Learning will come primarily from experience making decisions to implement the technology, having done so in practice at some point.
Absence of staff on the team	High	Low	In the event of staff absence due to holidays, sickness or leaving the post, there is capacity for other staff with experience of conducting health and social care evaluations to join the team offering

			additional support, particularly from RAND Europe, where staff often work on multiple projects and have the ability to work flexibly. Jennifer Bousfield will be on maternity leave from mid-April and cover has been secured (see Table 2).
Loss of data	High	Low	Although unlikely that data loss would occur, the University of Birmingham and RAND Europe have resilient, well-tested IT systems with data from all computers backed up in multiple locations which would enable the recovery of any lost data on local servers. The study team will ensure transfer of data from case study sites to RAND or University of Birmingham will be done according to GDPR guidelines.

Ethical issues and approvals required

For ethical approval, our protocol will be divided in two. Phase I interviews with decision makers and operational leads and Phase II interviews with staff will be submitted as a service evaluation through the UoB (as sponsor). For Phase II interviews with service users and carers, will we submit an application for ethical review by the UoB Research Ethics Committee. As this study is a service evaluation, approval by the HRA or an NHS Research Ethics Committee is not required. For further clarification, the project manager will contact Dr Birgit Whitman, Head of Research Governance & Integrity, UoB for confirmation.

As mentioned above (and shown in Table 6), our team have experience conducting research with local authorities and care providers, staff working with service users, and service users and carers. There are some key ethical considerations for this study. The first is addressed in Table 5 (potential risks and mitigation strategies) and relates to sensitive and appropriate contact with local authorities and care providers. Other considerations include:

1. Sensitivities around interviewing participants

Interviews will be conducted via telephone or online to reduce the spread of Covid-19 and in line with government public health guidance. Benefits of online or video data collection have been acknowledged, including reduced travel time for researchers, and ease of scheduling a time that is suitable for interviewees (Rowley, 2012). There are, however, some drawbacks to conducting interviews online or over the phone. For instance, it can be more difficult to build rapport, or monitor how a participant is feeling (Iacono et al., 2016). Since the start of the Covid-19 pandemic, however, the research team have been developing their skills in online and telephone interviewing with healthcare professionals and service users and carers. The team have in place some techniques and solutions for ensuring interviews are conducted appropriately and that participants feel comfortable. These include:

- Sending a lay information sheet outlining the project and the topics of discussion ahead of time (McGrath et al., 2019).
- Spending more time on rapport building prior to the interview commencing than one may spend with face-to-face interviews. For instance, by spending more time on introductions and getting to know the participant and how they are feeling that day (Iacono et al., 2016).
- Active listening and where possible, paying attention to participants' body language and facial expressions (Iacono et al., 2016). In addition, interviewers will specifically 'check-in' with participants throughout and at the end of the interview, asking how they are finding the interview to ensure their wellbeing.
- Careful consideration and planning for technical issues such as poor internet connection or image quality. Some participants may be unfamiliar, or uncomfortable with certain online platforms. Therefore, we will offer a range of options for participating (e.g. telephone or online). Participants will be provided with a telephone number as back-up, should these issues arise. When inviting participants to the interview, the research team will explain that they can give a walk-through of how to use the video conference equipment, should participants be unfamiliar with the technology.
- Good practice and regulations for security and confidentiality will be upheld. Members of the research team will provide additional reassurance that information they provide is confidential, particularly where interviews are being recorded (which will only be done with participants' consent). Furthermore, only video platforms approved by BRACE will be used to ensure IT security. Participant confidentiality will be ensured by the researcher conducting

the interview being in a private location and taking time at the start of an interview to ensure interviewees are comfortable and are in a suitable location (Andrews, 2020).

- The team will also hold regular team meetings over the course of the study to share tips and experiences and continue to perfect their skills.

2. Protecting reputational damage of technology provider

Although the focus of the evaluation is on new and emerging technology generally, we use the example of a specific technology provider. To protect the reputation of the provider, this will be anonymous in all published results and outputs.

3. Gaining balanced views

Some stakeholders may not have had a positive experience with the technology, and their dissatisfaction or frustration may make them less keen to participate, or they may think we are only interested in success stories. Therefore, it is important that invitations to participate clearly outline the aims and potential benefits of the study (e.g. learning from past experiences and providing local authorities and care providers with better information for future decisions).

Participant consent

As explained in the methodology section (WP1), information sheets and consent forms will be shared with potential participants, which will detail the study aims, design, risks, benefits and who they may contact if they have further questions. The information sheet with also make clear that participants have a right to withdraw from the study at any point, without needing to give a reason. Information sheets and consent forms will be shared with potential participants via an email link to an online platform such as Qualtrics, an online platform that can be used for recording participant consent for research. Alternatively, if a participant does not have access to a computer or the internet, they will be posted a consent form and information sheet with a pre-paid stamp and envelope. Each participant will have returned a consent form prior to commencing their interview and will be given a week to two weeks to decide whether they would like to participate. The approach to obtaining informed consent from participants was informed by advice and guidance of the HRA and UoB ethics team.

Confidentiality

The identity of all participants will be kept anonymous, as will the case study sites and the technology provider (a pseudonym will be used). This is to guard against reputational risk in situations where authorities or providers may have experimented with new ways of working and not been able to deliver desired outcomes. During our scoping work, sites felt that this was a helpful safeguard which would maximise their ability to share genuine learning whether outcomes were positive or negative. All data, therefore, will be anonymised and during transcription, any sensitive identifiable information will be censored. Data stored on research team laptops will be both password and bit locker protected. All electronic data will be stored and held securely on a restricted access network, and paper copies of information sheets and consent forms will be kept in a locked filing cabinet. Participant identifier codes will be stored separately from the anonymised interview transcripts.

Indemnity and insurance

The University of Birmingham holds the relevant insurance cover for this study, as confirmed via our BRACE contract with NIHR.

Sponsor

The University of Birmingham will act as the main sponsor and guarantor for this study.

Data storage

The project team will store data at the University of Birmingham for up to five years after data collection is complete (or until it is no longer necessary). Data will then be archived for 10 years in accordance to University of Birmingham research governance processes.

Funding

BRACE, including this evaluation, is funded by the NIHR Health Services and Delivery Research (HS&DR) programme (HSDR16/138/31).

Research team

Table 2 presents the team members and their corresponding roles and expertise.

Table 6. Study team members

Team member	**Role and contribution in research team**	**Relevant expertise**
Jon Glasby, Professor of Health and Social Care, University of Birmingham	Principal Investigator	A qualified social worker by background, Jon specialises in research, teaching and policy advice concerning adult social care policy and practice, personalisation, strategic commissioning, health and social care partnerships and services for older people. Previous NIHR projects include research into the nature and contribution of community hospitals, older people's experiences of emergency hospital admissions, market shaping in adult social care, and prevention and well-being.
Jennifer Bousfield, Analyst, RAND Europe	Project conception, data collection, analysis, facilitation of project workshops, writing of reports/dissemination	Jennifer has a background in research on health and social care topics. This includes research on health, symptomatology and daily living in older adults with and without a diagnosis of dementia, and more recently, research on Covid-19 home monitoring (including in care home settings). She has extensive experience of project managing research studies and collecting and analysing qualitative data. She was recently the project manager and researcher on a study of social inclusion and mental health, which included conducting and analysing interviews and focus groups with staff, service users and carers.

Denise Tanner, Senior Lecturer in adult social work/social care policy	Interviews with key stakeholders and advisory support throughout the project	Denise is an experienced qualitative researcher, with much of her work focusing on older people's experiences of social care. She has particular interest, and experience in participatory approaches that seek to involve service users in research processes. Her previous work includes research with people with dementia. She is also a registered social worker with extensive practice experience of social work with adults.
Sarah Parkinson, Analyst, RAND Europe	Data collection, data analysis, and write-up of study findings	Sarah Parkinson has a research interest is in public health and healthcare. She is experienced in conducting literature reviews, interviews, surveys and focus groups, along with qualitative analysis. Sarah has experience of undertaking evaluations in health and social care. For instance, she was recently project manager and analyst on a BRACE rapid evaluation on Primary Care Networks.
Bridget Roe, Research Fellow, University of Birmingham	Contribution to the preparation of research materials, data collection, data analysis, and write-up of study findings	Bridget has a background as a nurse, midwife and healthcare manager. Her research includes healthcare policy, changing organisation and governance of healthcare services, systems leadership, professional learning in organisations, and implementation of improvements. Her research is qualitative and often ethnographic. She has experience in a wide variety of qualitative methods including the innovative 'Interview to the Double'.

References

Andrews, U. o. S. (2020). Online or telephone interviews and focus groups. Retrieved from https://www.st-andrews.ac.uk/research/integrity-ethics/humans/ethical-guidance/remote-qual-ints/

Barrett, D., Thorpe, J., Goodwin, N., Barrett, D., Thorpe, J., & Goodwin, N. (2015). Examining perspectives on telecare: factors influencing adoption, implementation, and usage. *Med Device Evid Res, 8*, 11-19.

Bemelmans, R., Gelderblom, G. J., Jonker, P., & De Witte, L. (2012). Socially assistive robots in elderly care: A systematic review into effects and effectiveness. *Journal of the American Medical Directors Association, 13*(2), 114-120. e111.

Braun, V., & Clarke, V. (2006a). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.

Braun, V., & Clarke, V. (2006b). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3(2)*.

Carers UK. (2012). *Carers and telecare* https://www.carersuk.org/for-professionals/policy/policy-library/carers-and-telecare-report

Charlesworth, A., & Johnson, P. (2018). *Securing the future: funding health and social care to the 2030s* (1911102990).

Chrysanthaki, T., Hendy, J., & Barlow, J. (2013). Stimulating whole system redesign: Lessons from an organizational analysis of the Whole System Demonstrator programme. *Journal of health services research & policy, 18*(1_suppl), 47-55.

Daly Lynn, J., Rondón-Sulbarán, J., Quinn, E., Ryan, A., McCormack, B., & Martin, S. (2019). A systematic review of electronic assistive technology within supporting living environments for people with dementia. *Dementia, 18*(7-8), 2371-2435.

Dixon, J. (2020). *Health Foundation response to ONS data on deaths involving COVID-19 in the care sector and the results of the COVID-19 surveillance study in care homes (Vivaldi).* Retrieved from https://www.health.org.uk/news-and-comment/news/staffing-issues-in-care-homes-have-contributed-to-covid-19-infections

Doughty, K., Cameron, K., & Garner, P. (1996). Three generations of telecare of the elderly. *Journal of telemedicine and telecare, 2*(2), 71-80.

Felizardo, K. R., Mendes, E., Kalinowski, M., Souza, É. F., & Vijaykumar, N. L. (2016). Using forward snowballing to update systematic reviews in software engineering. Proceedings of the 10th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement,

Greenhalgh, T., Procter, R., Wherton, J., Sugarhood, P., Hinder, S., & Rouncefield, M. (2015). What is quality in assisted living technology? The ARCHIE framework for effective telehealth and telecare services. *BMC medicine, 13*(1), 91.

Greenhalgh, T., Wherton, J., Papoutsi, C., Lynch, J., Hughes, G., Hinder, S., Fahy, N., Procter, R., & Shaw, S. (2017). Beyond adoption: a new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *Journal of medical Internet research, 19*(11), e367.

Henderson, C., Knapp, M., Fernández, J.-L., Beecham, J., Hirani, S. P., Beynon, M., Cartwright, M., Rixon, L., Doll, H., & Bower, P. (2014). Cost-effectiveness of telecare for people with social care needs: the Whole Systems Demonstrator cluster randomised trial. *Age and ageing, 43*(6), 794-800. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4204660/pdf/afu067.pdf

Henderson, C., Knapp, M., Fernández, J.-L., Beecham, J., Hirani, S. P., Cartwright, M., Rixon, L., Beynon, M., Rogers, A., & Bower, P. (2013). Cost effectiveness of telehealth for patients with long term conditions (Whole Systems Demonstrator telehealth questionnaire study): nested economic evaluation in a pragmatic, cluster randomised controlled trial. *Bmj, 346*.

Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., Bower, P., Bowen, R., Fitzpatrick, R., & Bardsley, M. (2012). An organisational analysis of the implementation of telecare and telehealth: the whole systems demonstrator. *BMC health services research, 12*(1), 403.

HM Government. (10 June 2019, 18 October 2019). *A guide to using artificial intelligence in the public sector: Guidance on building and using artificial intelligence in the public sector.* https://www.gov.uk/government/collections/a-guide-to-using-artificial-intelligence-in-the-public-sector

HM Government. (2017). *Industrial Strategy Building a Britain fit for the future*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

HM Government. (2020). *Personalised health and care 2020, Using data and technology to transform outcomes for patients and citizens.* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/384650/NIB_Report.pdf

House of Commons Health and Social Care and Housing. (2018). . Retrieved from https://commonslibrary.parliament.uk/research-briefings/cbp-7903/

Hutchings, R. (2020). *The impact of Covid-19 on the use of digital technology in the NHS*. https://www.nuffieldtrust.org.uk/files/2020-08/the-impact-of-covid-19-on-the-use-of-digital-technology-in-the-nhs-web-2.pdf

Iacono, V. L., Symonds, P., & Brown, D. H. (2016). Skype as a tool for qualitative research interviews. *Sociological Research Online, 21*(2), 1-12.

Knapp et al. (2016). *The case for investment in technology to manage the global costs of dementia,*

. https://piru.ac.uk/assets/files/Dementia_IT_PIRU_publ_18.pdf

Lariviere et al. (2018). *The role of technology in making care arrangements sustainable* http://circle.group.shef.ac.uk/wp-content/uploads/2018/12/SC-Policy-Perspective-Technology.pdf

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2019). Twelve tips for conducting qualitative research interviews. *Medical teacher, 41*(9), 1002-1006.

Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., & Wight, D. (2015). Process evaluation of complex interventions: Medical Research Council guidance. *Bmj, 350*.

Papadopoulos, I., Koulouglioti, C., Lazzarino, R., & Ali, S. (2020). Enablers and barriers to the implementation of socially assistive humanoid robots in health and social care: a systematic review. *BMJ open, 10*(1).

Rostill, H., Nilforooshan, R., Barnaghi, P., & Morgan, A. (2019). Technology-integrated dementia care: trial results. *Nursing And Residential Care, 21*(9), 489-494.

Rostill, H., Nilforooshan, R., Morgan, A., Barnaghi, P., Ream, E., & Chrysanthaki, T. (2018). Technology integrated health management for dementia. *British journal of community nursing, 23*(10), 502-508.

Rowley, J. (2012). Conducting research interviews. *Management research review*.

Saldaña, J. (2016). *The Coding Manual for Qualitative Researchers* (Third Edition ed.).

Sanders, C., Rogers, A., Bowen, R., Bower, P., Hirani, S., Cartwright, M., Fitzpatrick, R., Knapp, M., Barlow, J., & Hendy, J. (2012). Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: a qualitative study. *BMC health services research, 12*(1), 220.

Skills for Care. (2018). *Scoping study on the emerging use of Artificial Intelligence (AI) and robotics in social care: Final Report.* . Retrieved from https://www.skillsforcare.org.uk/Documents/Topics/Digital-working/Robotics-and-AI-in-social-care-Final-report.pdf

Sriram, V., Jenkinson, C., & Peters, M. (2019). Informal carers' experience of assistive technology use in dementia care at home: a systematic review. *BMC geriatrics, 19*(1), 160.

The AHSN Network. (2018). *Accelerating Artificial Intelligence in health and care: results from a state of the nation survey.* . Retrieved from https://wessexahsn.org.uk/img/news/AHSN%20Network%20AI%20Report-1536078823.pdf

UK Government. (10 June 2019). *Government Technology Innovation Strategy.* . UK Government Retrieved from https://www.gov.uk/government/publications/the-government-technology-innovation-strategy/the-government-technology-innovation-strategy

Walton, H., Harshfield, A, Tomini, S, Ng, Pei Li, Cowan, K, Sussex, J, Fulop, N. (2019). *Innovations in Adult Social Care and Social Work Report.* . Retrieved from https://www.nuffieldtrust.org.uk/files/2019-11/adult-social-care-innovations-horizon-scanning-report-final-13112019.pdf

Watson, P., Bearpark, T., & Ling, J. (2020). The impact of rapid response and telecare services on elderly and vulnerable residents. *Health & Social Care in the Community*.

Woolham, J., Steils, N., Learning, T., & Forsyth, K. (2017). *The UTOPIA project: Using Telecare for Older People In Adult social care.* Retrieved from https://www.housinglin.org.uk/_assets/Resources/Housing/OtherOrganisation/Utopia_project_report-KCL.pdf

Wright, J. (2020). Technology in social care: review of the UK policy landscape. *CIRCLE, Sheffield*.