

T&SCon: Technology and Social Connectedness

Final Report

Louise McCabe, Alison Dawson, Elaine Douglas, Alison Bowes, Mike Wilson and Cate Pemble

University of Stirling

November 2019

**UNIVERSITY of
STIRLING**



Digital Health
& Care Scotland

Table of contents

Introduction	4
Executive Summary.....	5
What we did.....	5
What we found	5
Recommendations and guidance	6
What we did.....	7
Literature review	7
Technology scoping exercise.....	10
HAGIS data analysis.....	11
Focus groups	11
Analysis	12
Co-creation workshops	13
Analysis	16
What we found	17
Literature review	17
Search results	17
Data extraction and evaluation results	17
Narrative review	22
Key messages.....	36
Technology scoping.....	38
Examples of innovation	38
Notes on the technology scoping findings	39
Key messages.....	40
HAGIS data analysis.....	41
HAGIS Sample	41
Profiles of Social Connectedness.....	41
How do older people stay in touch with each other?	42
Socio-demographic Characteristics of the Profiles	44
How do older people value their social connections?	46
What is the relationship between social connectedness and loneliness?.....	49
Use of Technology	50
Key messages.....	51
Focus groups and Co-creation workshops	52
Challenges.....	52

Opportunities.....	53
Key messages and recommendations	55
Conclusions and next steps.....	56
References.....	57

Introduction

This project explored the potential of technology to address and ameliorate social isolation for adults, especially older adults, living in Scotland. The project extended findings from the RemoAge project, where technology enabled care solutions for frail older adults were evaluated, as well as conducting primary data collection from technology projects across Scotland. While this project included adults of all ages there is acknowledgement that older people are particularly vulnerable to social isolation (IBM Institute for Business Management 2017; Scottish Government 2018) and understanding how technology can be utilised for this group was found to have wider relevance.

Although they are often paired together, it is important to be clear about the conceptual difference between social isolation and loneliness as this helps in consideration of both potential underlying causes and the different ways in which each can be addressed. In a review focused on public health consequences Leigh-Hunt et al (2017) define 'social isolation' as the objective state of lack of social contact with others, and 'loneliness' as the subjective feeling of being unhappy with one's relationships. This project focused on the former, looking at technology initiatives that aim to increase decrease social isolation. A decision was taken early on in the project to flip the focus to social connectedness as this more positive lens was a better fit with current relevant work across Scotland.

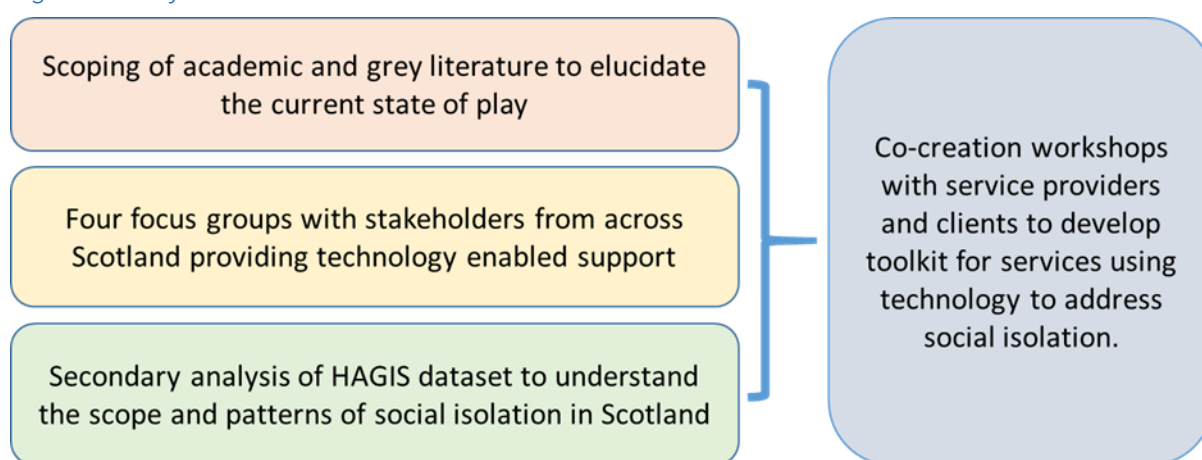
This report provides a detailed description of what we did, reflections on findings that emerged from the different aspects of the project and concludes by offering recommendations and guidance for organisations and individuals who wish to develop projects and services using technology to support social connectedness.

Executive Summary

What we did

This was a mixed methods study with four specific components: a review of evidence; secondary analysis of the Health Ageing in Scotland dataset; focus groups with a range of stakeholders; and co-creation workshops to refine the findings from these three activities. A mixed methods approach was taken to ensure we drew upon all available evidence from a diverse range of sources to strengthen the evidence base, which was then validated with current stakeholders involved in the delivery of technology projects to support social connectedness. These activities are presented in Figure 1.

Figure 1. Project methods



What we found

Our technology scoping exercise identified a wide range of UK-based and international technology-based or technology-enabled services and interventions designed to support social connectedness and targeted at different adult user groups. However, there is relatively little research evaluating the effectiveness of such services or interventions reported in the academic literature.

Identified publications within the literature review most frequently describe the development and small-scale piloting or prototype testing of services to support older people's social connectedness through internet-based services with little discussion of the scalability, sustainability or practical implementation of services. So, while positive results are presented, it is not possible to generalise from many of these studies.

Analysis of the Healthy Ageing in Scotland (HAGIS)¹ dataset revealed patterns of social connectedness amongst people over 50 living across Scotland providing a deeper understanding of the complex relationship between social connectedness and loneliness. The HAGIS analysis further revealed a varied pattern of technology use across different groups which suggests that those who are least socially connected may also be those least

¹ <https://bmjopen.bmj.com/content/8/1/e018802.info>

likely to utilise technology to connect with others, revealing important considerations for this project and for stakeholders working in health and social care settings.

The focus groups and subsequent co-creation workshops revealed information about current projects utilising technology to support social connectedness across Scotland and involving a range of different service groups. Reflections on the successes and challenges faced by these projects revealed the importance of careful consideration of the target group; the breaking down of assumptions about who uses technology and who doesn't; and risks and opportunities of using technology for this purpose. The co-creation workshops enabled refinement and further analysis of the data from across the project to support the recommendations and guidance presented below.

Recommendations and guidance

We found positive examples of technology supporting social connectedness both **directly**, for example, using Skype to connect with family overseas, and **indirectly**, by technology freeing up time and energy for social activities, for example, accessing NHS support through text messaging or videoconference.

The following recommendations emerged for organisations and individuals thinking about using technology to support social connectedness:

PEOPLE: recognise potential users as individuals, avoiding assumptions about age, gender, disability etc., and protecting human rights.

RISK: careful consideration of risks for individuals is needed but balanced presentation of risks, taking account of individual choice, is important.

PARTICIPATION: get staff and potential users on board from the start, involving them from the planning stages onwards.

SYSTEMS: carefully assess infrastructure as well as devices for cost, accessibility, suitability and usability.

TRAINING: users will need support and training to use new devices, peer-to-peer learning, hands-on demonstrations, and simple take-home instructions are recommended.

A toolkit offering guidance to organisations and individuals using technology to promote social connectedness as well as access to the fuller data sets collected in the literature review, technology scoping exercise and HAGIS analysis are all available at www.tech.scot. The guidance includes the elements described in Figure 2.

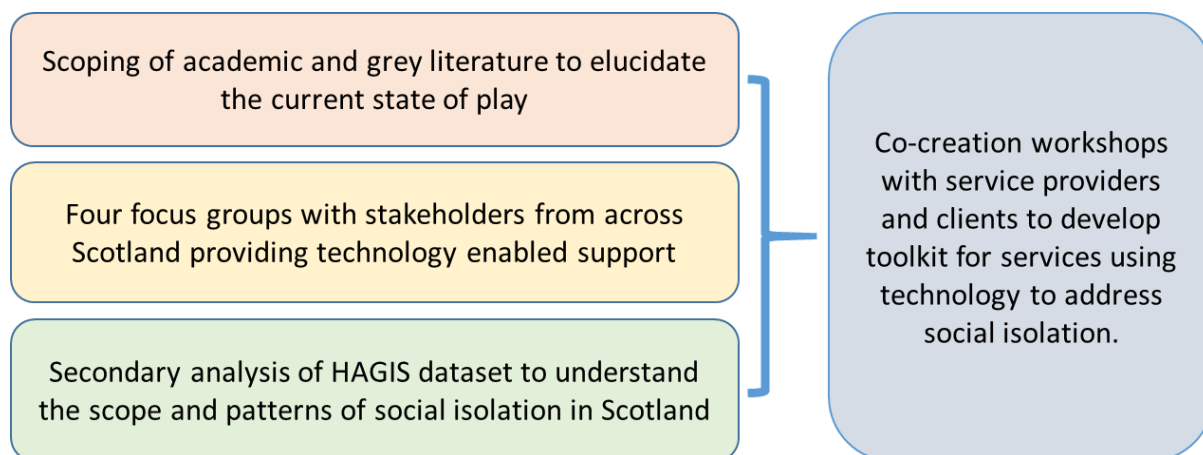
Figure 2. Guidance schema



What we did

This was a mixed methods study with four specific components: a review of evidence; secondary analysis of the Health Ageing in Scotland dataset; focus groups with a range of stakeholders; and co-creation workshops to refine the findings from these three activities. These activities are presented in Figure 1.

Figure 1. Project methods



Literature review

The purpose of the review is to assess and report on the research evidence base for the effectiveness of technology enabled interventions to improve social connectedness for adults and to inform the development of evidence-based guidance for organisations or individuals involved in the development of such services. Insights gleaned from this examination of published academic literature are intended to complement the other strands of data gathering activity described in Figure 1 above.

We conducted the review following a protocol developed as part of the ‘Stirling literature review method’. This method has been successfully used to provide a rigorous assessment of the evidence base in a range of contexts, e.g. physical activity for older people (Bowes, Dawson, Jepson, & McCabe, 2013); home care services for people with dementia (Dawson, Bowes, Kelly, Velzke, & Ward, 2015); volunteering outcomes (Rutherford, Bu, Dawson and McCall, 2019); design of residential environments for people with dementia (Bowes and Dawson, 2019). The search strategy, described in more detail below, is designed to rigorously and systematically interrogate the evidence base to identify research of direct relevance.

Eligible publications are subject to data extraction and evaluation using the ‘Stirling literature review proforma’ which has been tailored to the project and designed to capture data in line with the objectives of the literature review. The data extracted from articles include a summary of the key findings of the work, data about the nature of the research described, and authors’ key conclusions and recommendations for further research. In the course of completing the Stirling proforma, reviewers identify the research design of the item being reviewed, and then answer a series of evaluation questions relating to specific research designs based on standard protocols widely used in reviewing. These include: the

Centre for Research and Development (CRD) Report No. 4 used for randomised controlled trials; Cochrane Effective Practice and Organisation of Care (EPOC) checklists used for controlled before-after studies; and, Critical Appraisal Skills Programme (CASP) assessment criteria used for literature reviews and qualitative studies (CASP, 2013; EPOC, 2015; NHS CRD, 2001). Having responded to detailed evaluation questions reviewers are then asked to rate it as of high, medium, or low quality and to record their reasons for doing so. Thus, each study is quality assessed according to specific criteria relating to studies using the same approach, and assessments are structured and consistent within study type without implying a hierarchy between types of research evidence.

Following test searches designed to assess search string specificity and sensitivity and overall feasibility given review time and resource constraints, we conducted searches of the electronic bibliographic databases detailed in Table 1 using search strings constructed from combinations of search terms set out in Table 2. Separate strings were used to search dementia and ageing-related literatures for potentially relevant publications.

Table 1. Bibliographic database services used in this review

Bibliographic database services	Comments
EBSCOhost	This service was used to simultaneously search the following individual bibliographic databases: CINAHL Complete; EconLit; Education Research Complete; Health Source: MEDLINE; Nursing / Academic Edition; PsycINFO; SocINDEX with Full Text.
ScienceDirect	This service provides access to 1000+ journals published by Elsevier across various subject areas, including economics, management, psychology and sociology.
Web of Science Core Collection	This service was used to simultaneously search the following individual bibliographic databases: Science Citation Index Expanded (SCI-EXPANDED); Social Sciences Citation Index (SSCI); Arts & Humanities Citation Index (A&HCI); Emerging Sources Citation Index (ESCI).
Social Services Knowledge Scotland (SSKS)	This service was used to simultaneously access the following bibliographic databases via ProQuest: Applied Social Sciences Index & Abstracts (ASSIA); Public Health Database; Sociological Abstracts; Social Services Abstracts.

Table 2. Search terms

Relating to social isolation	Relating to population of interest	Relating to technology
(social* AND isolate*) OR (social* AND connect*) OR lonel*	adult* OR 'older' OR elder*	technolog* OR 'SMS' OR telephon* OR internet OR 'social media' OR online OR ICT OR video* OR virtual OR digital

Inclusion and exclusion criteria for the review, set out in the ‘SPIO’ (Study, Population, Intervention, Outcomes) format, are shown in Table 3. The publication date criterion for inclusion was set at ‘first published on or after 1 January 2008’ to exclude reports of research. The rapid pace of change in terms of ICT infrastructure, cost and availability of ICT hardware and software, ubiquity of devices and range of applications over the last decade may have significantly influenced both the feasibility and the acceptability of ICT-based interventions for increasing social connectedness. The choice of date for inclusion reflects our concern that the findings of older research may not be fully generalizable to a changed contemporary social and technological landscape.

Table 3. SPIO table illustrating review inclusion and exclusion criteria

	Include	Exclude
Studies	<ul style="list-style-type: none"> • <i>Language</i>: Studies where the full text is provided in English • <i>Publication date</i>: Studies first published on or after 1 January 2008 • <i>Study types</i>: reports of primary qualitative or quantitative or mixed methods research, case studies of existing interventions or services • (NB: retain reviews of research for examination of included items) 	<ul style="list-style-type: none"> • <i>Language</i>: Studies without a full text in English • <i>Publication date</i>: Studies first published before 1 January 2008 • <i>Study types</i>: Study protocols without reports of primary research, reviews of published articles reporting primary research, articles which do not report research, conference abstracts or conference proceedings
Population	<ul style="list-style-type: none"> • Human adult sample populations, including studies limited to older adults howsoever described 	Child sample populations or young people where the sample population includes people under the age of 18
Intervention	<ul style="list-style-type: none"> • Any intervention which is a) described as either intended to reduce social isolation or loneliness or increase social connectedness, and b) is based on, incorporates the use of, or is delivered via ICT, internet-based or other digital technologies OR uses such technologies to facilitate service user access to services intended to reduce social isolation or loneliness or increase social connectedness 	<ul style="list-style-type: none"> • Interventions which do not have the reduction of social isolation or loneliness or increase of social connectedness as an only or main aim. • Interventions which do not incorporate the use of ICT, internet-based or digital technologies or use such technologies to facilitate user access to services.
Outcomes	<ul style="list-style-type: none"> • Changes in social connectedness and its 	

	Include	Exclude
	constituent elements (quality, type, frequency, and emotional satisfaction of social ties) <ul style="list-style-type: none"> • Changes in objective or subjective physical, social, and psychological health • Changes in objective or subjective ability and motivation of research participants to access support for themselves • Changes in the perceived or objective quality of the environment and community in which research participants live • Feasibility of intervention • Acceptability of intervention • Usability of intervention technology 	

We carried out searches using each of the bibliographic database services detailed in Table 1 on 17-18 January 2019 and downloaded search results into EndNote reference management software for processing and evaluation.

Technology scoping exercise

The technology scoping exercise involved a wide ranging internet search for current projects and initiatives using technology to support social connectedness. The search utilised the search terms: social isolation, social connectedness, loneliness, technology, technology enabled care, and social prescribing. In addition to this open search we also searched within websites from organisations that support adults in the UK with a focus on either social connectedness or technology, these included: Alzheimer Scotland, Scottish Centre for Telehealth and Telecare, Campaign to end loneliness, AgeScotland, AgeUK, Age Friendly Cities, Big Lottery, Life Changes Trust, Carnegie Trust, Centre for Ageing Better/Good Things Foundation, RNIB, Scottish Digital Health and Care Learning Network, care technology companies, local authority and NHS health board websites and Scottish Enterprise. Examples were also drawn from research projects with a focus on technology and social connectedness: MPower, RemoDem, RemoAge, and ALISS.

Due to the wide scope of this topic it is not possible to describe this search as systematic or complete. However, the resulting dataset does provide a wide ranging set of projects that demonstrate the different ways that technology is being used to support social connectedness, in different settings and with different groups. We also found that similar

kinds of projects started to come up repeatedly as the search progressed suggesting that we had found the most common types of project or intervention in current use.

For each identified project or technology we included a record in the database that noted:

- Name and detail of project and technology utilised
- Purpose(s) of technology: Entertainment/Communication/Social Interaction/Task orientated
- Project type: Research/Practice
- Setting: Home/Community/Day centre/Care home/other
- Type of technology
- Target group: Older people/adults/everyone/care recipients (e.g. care home residents)
- Links to webpages, publications etc.
- Identified outcomes relating to social isolation among older people

A summary of findings is presented later in the report and the whole database can be accessed through the link in the guidance towards the end of this report.

HAGIS data analysis

We used data from the Healthy Ageing in Scotland (HAGIS) study² to understand the relationship between social connectedness, loneliness, and use of technology in an older population in Scotland. The HAGIS study interviewed over 1,000 adults aged 50+ across Scotland in 2017. The interviews asked a wide variety of questions covering social, economic, and health issues, including topics such as social connection and internet use.

We measured social connection by considering both the quantity and quality of social interactions. HAGIS addressed the quantity of social connections by asking respondents how often, and by which means (meeting up, telephone, email/text), they communicate with their children, family, and friends. Respondents were then asked if they had close relationships with their children, family and friends: i.e., the quality of their social interactions. We also looked at the relationship between social connectedness and loneliness.

We addressed internet use by looking at a series of questions on the frequency and function of internet use, where people accessed the internet, and which type of device they used.

We used latent class analyses to identify distinct profiles of social connectedness in the older Scottish population. We then looked at the population characteristics of the profiles: age; sex; marital status; education; current status (retired, employed, long-term sick or disabled, etc.) and rurality. Finally, we looked at the association between the profiles and the quality of their social connections, loneliness, and internet use.

Focus groups

We held a series of four focus groups with stakeholders from across Scotland. Discussion at the focus groups was about the experiences of participants in using technology to promote social connectedness; the challenges experienced in delivering projects and in using

² <https://bmjopen.bmj.com/content/8/1/e018802.info>

technology; and reflections on the current and potential use of technology to support social connectedness.

Each focus group lasted around 60 minutes and they were lively discussions with all participants playing an active part.

Focus groups were audio recorded and then detailed notes were written up from each audio file. Two members of the project team facilitated the larger, in-person focus groups A and B while just one team member facilitated the group D and the videoconference group C. A short description of the participants in each groups follows.

Focus group A

The focus group was held in a rural and remote region of Scotland and as hosted by local NHS staff working on a technology focused project. There were six participants including the project lead, the project worker, a multiple sclerosis nurse, a manager from Alzheimer Scotland, an NHS health promotion officer and an NHS planning and development officer.

Focus group B

This focus group was held at the University of Stirling, drawing stakeholders from across the Central belt. There were ten participants including three older people, a member of staff from a third sector older people's organisation, a representative for a housing provider, a representative of Scottish Care, a manager from a disease-specific charity, two members of staff from a sight-loss charity and a manager from a technology company.

Focus group C

The focus group with a remote, island community was conducted using a videoconference link and was attended by six older people who were part of a community project using technology to connect with others. Three local members of staff supported them at the group.

Focus group D

Focus group D was held in a rural area of Scotland and involved three stakeholders: a technology project lead for that region, a family carer who is active in several volunteer roles and a NHS community development worker.

Analysis

Notes from the focus groups were reviewed to identify key themes, particularly highlighting the challenges and opportunities for using technology to support social connectedness. It is of interest to note that at the focus groups many of the **participants discussed their own use of technology for social connectedness alongside their professional or practice experiences** of supporting others to use technology. So the key themes emerging are relevant to people accessing health and social care services but also to the wider adult population in Scotland.

The findings from the focus groups were utilised to develop the exercises undertaken in the two co-creation workshops, where findings were re-evaluated and refined. The iterative process supported participants to play an active role in the data analysis and refinement and in the final presentation of findings that follow towards the end of this report.

Co-creation workshops

Two co-creation workshops were held to review and refine the findings from the literature review, technology scoping exercise, HAGIS analysis and focus groups. The co-creation workshops involved a series of exercises that helped to further the analysis of the data and to refine findings from across the project, enabling the development of a final set of findings and recommendations.

The first co-creation workshop was held at the University of Stirling and included six participants and three members of the project team who undertook three exercises together to further refine the project findings.

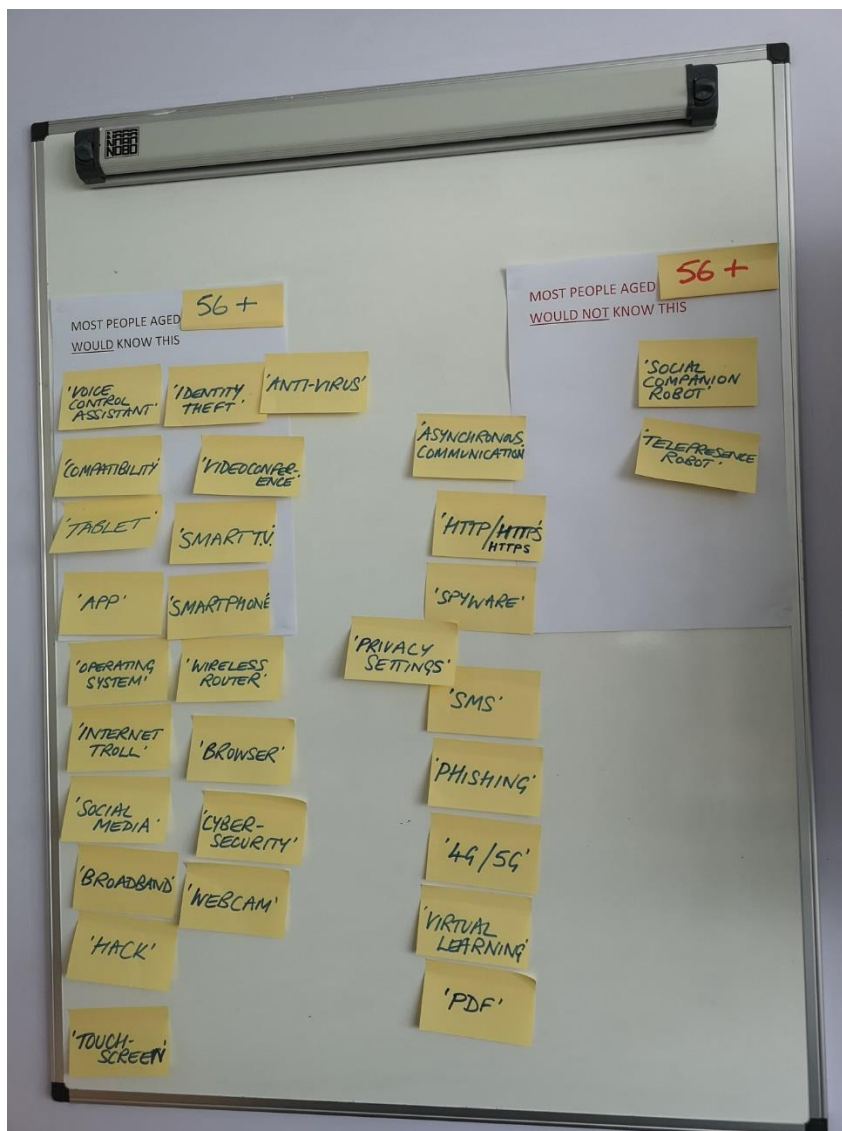
Participants included: the technology lead for a Scottish charity, the dementia lead for Scotland for an international charity, an older person with sight-loss and a support worker from a sight-loss charity, a nurse from a disease-specific charity, and the workforce lead for a Scottish charity.

The three exercises were as follows:

Ranking of key themes: the key themes from the focus groups had been coded and grouped under a series of headings split broadly across **opportunities and challenges: security and risk, accessibility and equality, individual engagement with technology, staff buy-in and support, technology making life easier** (so more time and energy for social connection), **keeping in touch, training and education, community potential, and delivering services and support**. A series of themes were included under each heading and workshop participants were asked to rank the importance of each theme by placing a coloured sticker that indicated if, in their opinion that theme was: very important, quite important or not important. At the end of the exercise it was possible to rank the themes in order of importance. Participants were also asked to add any themes they felt had been missed or alter the themes provided. This exercise was further developed for the second co-production workshop, described below.

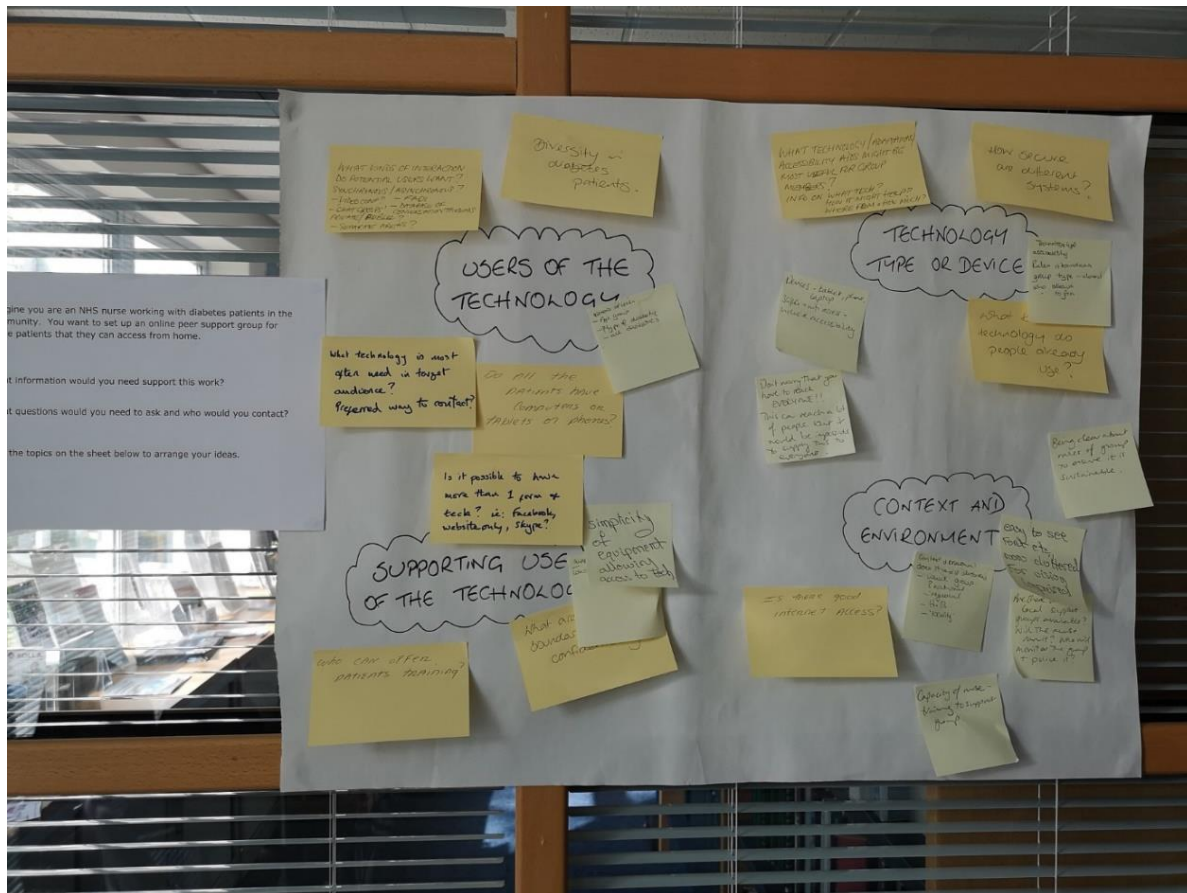
Review of terminology: workshop participants were provided with a long list of technology related words and asked to assess whether each word would be understood by people of different age groups (18 – 25, 26 – 55, 56 and over). Words were checked amongst the group for clarity and understanding and then a decision was made on whether they would be understood by each age group. The participants decided that nearly all the words would be understood by all ages with just a few words thought unlikely to be understood by the oldest age group, as illustrated in the image below.

Image 1. Review of terminology for people over 56 years of age WS1



Planning exercise: Participants were provided with two short project descriptions and asked what information they would need in order to set up each project, thinking across four domains: users of the technology, type of technology, context/environment and what was needed to support use of the technology. Participants provided questions that they thought would need to be answered prior to set up of the project described.

Image 2. Planning exercise WS1



Everyone in the workshop participated in the discussion and provided comments and feedback for all the exercises. Exercise one provided a clear ranking of **issues related to using technology** for social connectedness, exercise two helped us understand **the terms and language** that will work best when communicating about technology and the third exercise broadened our understanding of **the types of information** people would be looking for when setting up a project.

The second co-creation workshop also took place in Stirling, and involved three members of the project team and seven participants: a person with dementia; a technology lead from a community project, a technology lead for a local authority, a lead for an older person's technology service, an assisted living resident, a technology lead for a Scottish charity, and a technology enabled care project worker for Scotland. This workshop again involved three exercises. For this workshop the participants worked in two separate groups, one group of four people and one of three.

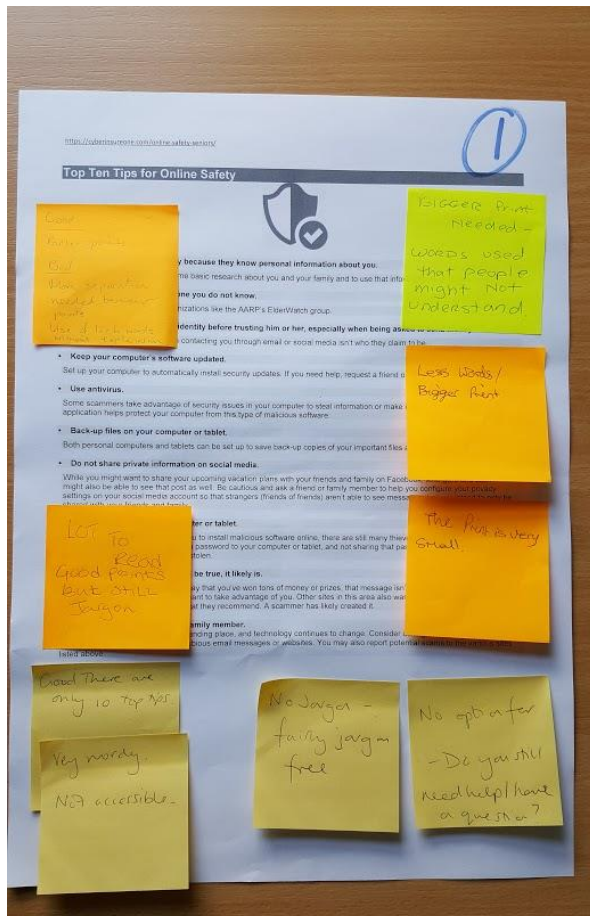
Ranking of themes: The themes discussed in the first workshop were presented again here but with the ranking as given to them in the first workshop and any additional issues added. The group considered and made suggested changes to the ranking and again added any additional issues to create a final ranked list of issues for each broad theme.

Case study building: Each group was given a different case study of an individual and worked together to construct a system of support for that individual using technology to support social connectedness. The support systems were constructed using a set of concentric circles representing the person's home, their local community and people outwith the local

community. Notes were also added about more general issues about using technology. Two detailed case studies were built up in this way.

Feedback on existing guidelines: a series of existing guidelines were printed out and left on a table to one side of the room, during the coffee break workshop participants spent time reading over the guidelines and provided comments both on the content of the guidelines but also, importantly, on how the guidelines were presented and how useful and accessible this presentation was.

Image 3. Feedback on existing guidance



Again, there was good participation by everyone attending this workshop and everyone was able to contribute to each of the exercises. The ranking exercise provided another layer of review and refinement to the themes that have emerged from the focus groups and underpins the final presentation of findings that follow. The case study exercise provided useful illustrations that will be used within the guidance presented at the end of this report. The final exercise where feedback was provided on existing guidance will directly feed into the guidance.

Analysis

Across the focus groups and co-production workshops a series of different types of data were collected in visual, audio and written form. Analysis of this varied dataset involved a broad thematic approach, utilising the key themes drawn from the focus groups as an analytical framework.

What we found

The main findings from each part of the project are presented in turn below.

Literature review

Search results

The PRISMA diagram in Figure 3 illustrates the results of searches and subsequent filtering of potential items for inclusion. Following the removal of intra- and inter-database duplicates, a total of 5,693 unique items remained and were examined for relevance by title. Of these, 360 were considered potentially relevant to the review and underwent further examination by title and abstract. Fifty-nine publications still appeared to be relevant on this basis, with 301 items (including 46 reviews of literature in related areas of research) discarded. Full text versions of each apparently relevant item were obtained. Each was read and considered for inclusion in the review based on the eligibility criteria set out in Table 3.

Thirty-one publications met the inclusion criteria and underwent data extraction and evaluation using the 'Stirling literature review proforma'. Twenty-eight publications were deemed not to meet the review inclusion criteria. The reasons for non-inclusion were recorded on the proforma and are summarised in the PRISMA diagram (Figure 1).

Full details of included studies, including information set out in 'SPIO' (Study, Population, Intervention, Outcomes) format can be in the Supplementary information on the literature review, at www.tech.scot.

Data extraction and evaluation results

Table 4 describes the included studies in terms of research design and evaluated quality of study, assessed as described in the review protocol and on the basis of information reported in the publication. This is an important caveat. Journal word limits *may* lead authors to be selective in the information that they include and leaving out details of specific aspects of the design or conduct of the study in the published paper *may* lead to a lower assessment of quality in this review. As Table 4 shows, 'Other research designs' (i.e. those for which we do not have a design-specific set of evaluation questions) accounted for more than half of included studies (16 out of 31). Qualitative studies and studies with 'before and after' (also known as 'pre-test, post-test') designs were the most common specific types of study included, each accounting for 7 out of 31 included studies. Fourteen included studies were classified as of 'Other research designs' (see foot of Table 4 for further details). It is important to note that the evaluation process for these studies relies on a single, more general set of evaluation questions rather than the more detailed question schedules available for some other designs.

Figure 3. PRISMA diagram illustrating results of search and filtering processes

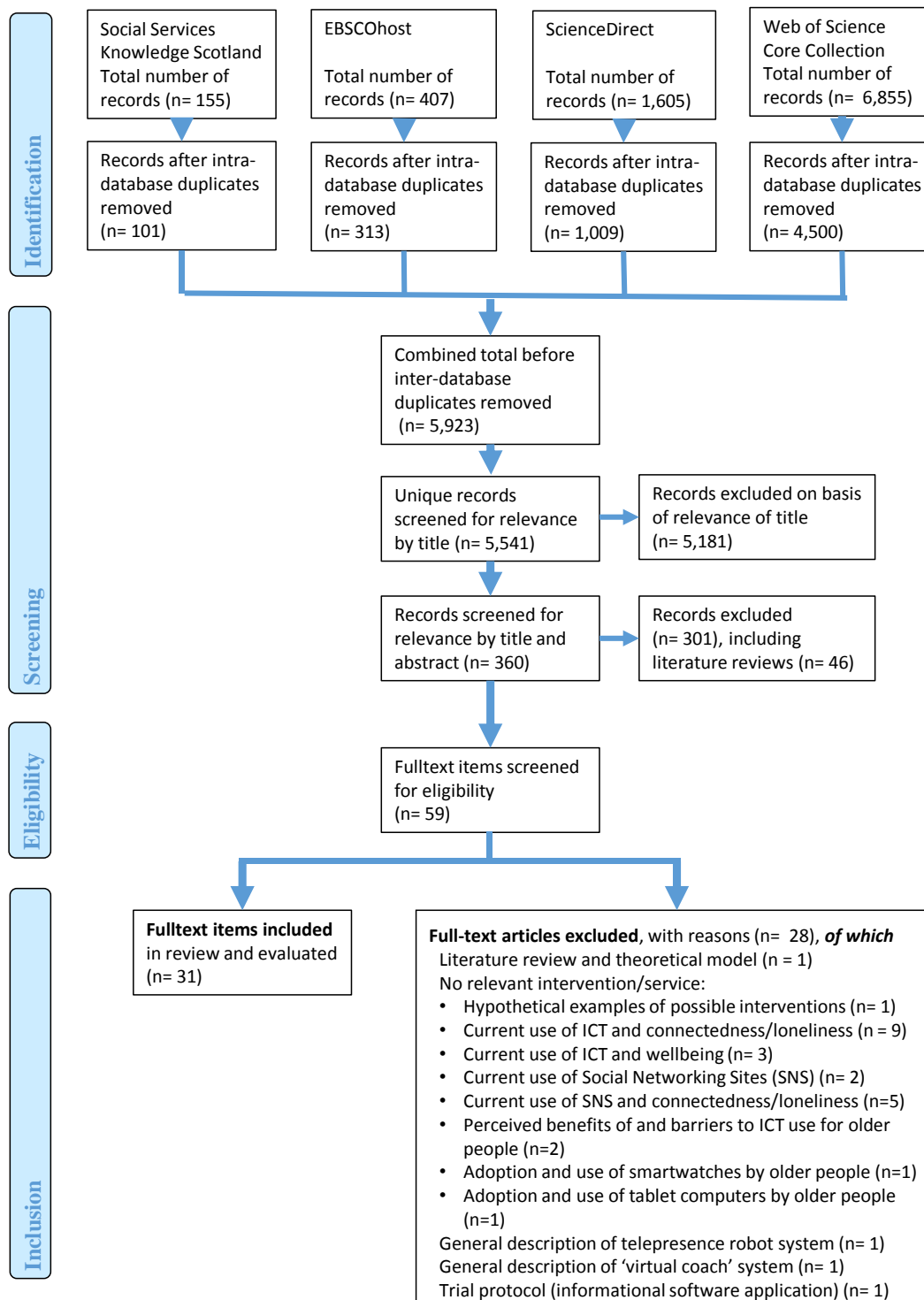


Table 4. Descriptive summary of included publications

Research design	Quality of study (evaluation based on reported information)			Totals
	High (minor limitations)	Medium (important limitations)	Low (major limitations)	
Controlled Before and After / Before and After study		7		7
Qualitative study	1	2	4	7
Other research designs*		10	6	16
Service description			1	1
Totals	1	19	11	31

*including 'quasi-experimental study', questionnaire/survey, repeated measures, 'participatory-action research', case study, mixed methods, 'laboratory-based experimental procedure'

Critically, no studies with Randomised Controlled Trial (RCT) or Clinical Controlled Trial (CCT) design were identified which met the inclusion criteria for this review. These types of design are typically used in larger medical or public health related studies which seek to robustly test and quantify an effect where prior piloting or feasibility testing of an intervention has suggested a (usually health-related) beneficial outcome. Studies of this type might have been expected, given the long-established relationship between social connectedness and mental health.

One potential explanation for their absence lies in the pace of technological change and its possible influence on research design. RCTs and CCTs normally take place over an extended period (3-5 years) and require significant research funding. There has been significant recent innovation in ICT and public acceptance and market penetration of new technologies can change very rapidly. For example, the first widely available smartphones came to UK markets in 2007 (first iPhone) and 2008 (first Android device), by 2011 27% of UK adults were smartphone users, rising to 78% of UK adults by 2018, with 96% of UK adults having access to mobile telephones of any type (OFCOM 2018). Similarly, the first iPad was introduced to the UK in 2010 and by 2018 58% of UK adults owned a tablet PC (ibid.). There is clearly risk that for studies conducted over a longer period the intervention technology becomes less relevant or even obsolete before the research has been completed and reported and this risk may act to deter both researchers and research funders.

Table 5 provides a breakdown of the categories of outcome that included papers considered. All but three of the 31 included studies considered changes in social connectedness or its constituent elements, the reporting of which is fundamental to this study. Those which did not were concerned with: describing the development of a robotic kit prototype in Italy which was intended, amongst other functions, to provide older users with access to videoconferencing, messaging, and other internet-based forms of communication with their circles of support (Borrelli et al 2015); discussing the development of prototype television-based and tablet computer-based social networking site interfaces to make them more accessible for older people (Coelho et al 2015); and reporting early acceptance testing of Sharetouch, a multi-touch interactive system

incorporating a simple social networking platform, rehabilitation exergaming and multimedia sharing via an interface embedded in a tabletop surface, with residents of an older people’s housing community in Taiwan (Tsai et al 2012).

Table 5. Outcomes of interest in included studies by category of outcome (n=31 studies; studies may have outcomes of interest in more than one category)

Outcome category	Number of studies with outcome of interest in this category
Changes in social connectedness or its constituent elements (quality, type, frequency and emotional satisfaction with social ties and/or interactions)	28
Physical health-related outcomes (e.g. strength, mobility, calorie intake, heart rate)	2
Self-reported psychological / emotional health-related outcomes (e.g. self-reported quality of life, happiness or well-being, mental health status)	16
Assessed psychological / emotional health-related outcomes (e.g. measures of depression)	9
Social health-related outcomes (e.g. availability of and satisfaction with social support, measures of social functioning)	18
Health or social care service use-related outcomes (e.g. hours of care provided, hospital admissions, GP visits)	2
Economic outcomes (e.g. quality adjusted life years (QALYs), length of hospital stays)	0
Sleep, sleeping patterns, or other sleep-related outcomes	0
Engagement/interaction with others, patterns of engagement, or other engagement-related outcomes	25
Outcomes relating to intervention feasibility	25
Outcomes relating to user acceptability of intervention and/or technologies used	27
Outcomes relating to usability of intervention technologies for intended user populations	27

As might be expected given the primary interest in social connectedness, the majority of included studies (25 out of 31) were also concerned with the extent of changes in mode, frequency or patterns of engagement or interaction with others, with a smaller number concerned with outcomes relating to aspects of social health (18 out of 31 studies). Reflecting the innovative nature and stage of maturity of the technologies and interventions detailed in many included studies, large proportions of included publications also considered outcomes relating to technology/intervention feasibility (25 studies), user acceptance (27 studies), and usability for intended populations (27 studies) where relevant.

Many included studies considered psychological / emotional health-related outcomes. Self-report psychological outcome measures were more widely used than more formal validated

assessment measures (16 studies compared to 9 studies) and only three studies used both. This may be a reflection of the small sample populations for many included studies: validated assessment measures may be perceived as less appropriate if the number of participants is too small to allow meaningful statistical analysis.

Only two of 31 included studies (Peter et al 2013, Banbury et al 2017) were assessed as specifically concerned with health or social care use-related outcomes and none were assessed as concerned with economic outcomes. The lack of larger included studies with controlled trial designs has already been noted. Service use and economic outcomes cannot easily be assessed when interventions are still at developmental stages and evaluation data are only available from small numbers of users.

Although the review protocol allowed for the inclusion of studies with any adult human sample populations, in the great majority of included studies (28 out of 31) the technologies/interventions reported were intended for older people in a range of different contexts. The three exceptions to this were McLaughlin et al's (2012) report of a videosharing social networking intervention for young adult cancer survivors, Sehrawat et al's (2017) research on an intervention which paired college students with older people to create digital stories as a tool for increasing social connectedness, and Wildvuur and van Dijk's (2011) discussion of Scottie, an ICT-based device designed to foster social connectedness between people who are physically or geographically separated from family and friends, which considered children in hospital and older care home residents as potential use cases.

Few included publications discussed practical considerations around intervention or service implementation, operation or sustainability. In the studies described, participating users were normally reported to be provided with the technology to facilitate interaction (27 of 31 studies), less frequently reported to be provided with interactive training to use the technology for social connection (provided in 21 out of 31 studies) and rarely provided with non-interactive training such as written materials or youtube videos (reported as provided in 5 out of 31 studies). Whilst research studies normally provide participants with ICT devices and interactive training opportunities, this may well not be the case for 'real life' services and interventions where users are perhaps more likely to be required to 'Bring your own device'. The effects of this would be to potentially replicate and deepen digital divides as those without devices would not be able to access interventions, and to introduce potential variability in outcomes due to device-related differences of those who did have them. Whilst studies such as that by Botner (2018) acknowledged that lack of access to suitable computer equipment presented a challenge to program delivery to part of the target population, in the four included studies where equipment was not provided there was no systematic comparison of the study participants with the target population across key demographic or socioeconomic variables. Given the likelihood that mainstreamed services will require user ownership of devices, this is something that future studies should address.

In the included papers, ICT was used in interventions and services primarily to mediate interaction, i.e. to provide the means by which interaction occurred. Even in systems integrating multiple categories of ICT little use was made of ICT to provide users with either general information about activities in their area, e.g. about local interest groups (reported as provided in 5 publications), or personalised information based on data provided by the

user about opportunities for interaction (reported as provided in 7 publications) that is often provided by social navigation services. Interventions instead appeared to focus on providing opportunities for real-time interaction with other people.

Issues of service, intervention or device accessibility were frequently discussed, appearing in 22 of the 31 publications. Infrastructure or technical issues with the intervention technology were less likely to be discussed, appearing in only 10 included publications. However, a range of more user-centric issues attract little or no attention, e.g. risks to users (alluded to in 5 papers), strategies for user safety, e.g. withholding personal information, using pseudonyms, etc. (discussed in 4 publications). None of the included items discussed legal requirements associated with the ICTs used in the services or interventions described or around the capture, storage and use of user-related information by the service or as a result of the intervention, e.g. need for compliance with the General Data Protection Regulation (GDPR) in relation to personal information. This lack of practical detail may be the result of included studies primarily reported on the development, piloting and testing of new interventions and services rather than describing the roll-out of interventions or detailing existing services. The practicalities of upscaling interventions and of wider implementation may not have been considered in detail at the point of reporting.

Narrative review

Background

Table 3, above, indicated that this review would include 'Any intervention which is a) described as either intended to reduce social isolation or loneliness or increase social connectedness, and b) is based on, incorporates the use of, or is delivered via ICT, internet-based or other digital technologies OR uses such technologies to facilitate service user access to services intended to reduce social isolation or loneliness or increase social connectedness'. Research studies for which there was no intervention, developed system or service were specifically excluded.

Twenty-four of the publications which were excluded following fulltext examination were excluded on this basis. However, it is worth looking briefly at the subject matter of these publications as this provides useful background context for the included studies.

A number of those 24 excluded studies used cross-sectional surveys or secondary analysis of survey data to examine the relationship between current ICT use (primarily the internet) and social connectedness, e.g. in Australia (Sum et al 2008), America (Hogebom et al 2010), Turkey (Şar et al 2012), South Africa (Chippis and Jarvis 2017). Often such studies also consider relationships between ICT use and subjective happiness, e.g. Lelkes' (2013) study of older Europeans using European Social Survey data, or subjective quality of life, e.g. Khalaila et al's (2018) cross-sectional study of older Israelis, or subjective well-being, e.g. Chan's (2015) examination of the effects of multimodal connectedness across all ages in adult Cantonese-speaking residents in Hong Kong internet use or Chopik et al's (2016) study of older Americans based on secondary analysis of data from the 2012 Health and Retirement Study.

These studies demonstrate broad international research interest in the potential of more recent developments in ICT to maintain or enhance levels of social connectedness and address social isolation. They tend to suggest a positive relationship between ICT/internet use and social connectedness, i.e. people who use ICT and internet-based communications

more tend to be more socially connected, but data collected at a single time point does not provide any insight into causality, i.e. whether people who use ICT and internet-based communications more *become* more socially connected as a result of that use. Moreover, many of these studies suggest ‘digital divides’, e.g. in relation to age, employment status / occupation, household income, education (number of years, attainment levels).

Other excluded studies used both qualitative and quantitative methods to specifically consider current social networking site (SNS) use, e.g. for specific populations, such as Darley et al’s (2017) study of SNS use by older adults caravanning through Australia, or to look at the relationship between current SNS use and social connectedness, e.g. Reidl et al’s (2013) study of Twitter use and social connectedness, Cho’s (2015) examination of use of communications and social networking site smartphone apps, social capital and social isolation in adult Koreans, Findlay and Nies’ (2017) exploration of social networking use for social connectedness among older adults living in rural parts of Idaho, USA, Doyle and Goldingay’s (2012) qualitative study of the experiences of five older Australians’ use of internet and social media, and Sinclair and Grieves’ (2017) study of Facebook as a source of social connectedness in older adults, which drew on a sample of primarily Australian, British and European Facebook users.

These studies similarly point to the potential of SNS use to maintain or enhance levels of social connectedness and address social isolation, but also reveal possible age-related differences in effects and underscore the importance of perceived usefulness of online social networks, perceived knowledge and self-efficacy in ICT use, and the accessibility and usability of hardware and software interfaces in influencing SNS use in different populations.

Several excluded studies focus specifically on perceived benefits and barriers to ICT use generally for older people, for example Gatto and Tak’s (2008) study based on a survey of members of a computer learning class in Southern USA and Hardill and Olphert’s (2012) study exploring mobile phone use amongst older adults in the UK. Others focus on the potential benefits and challenges associated with adoption and use of specific types of device, such as Tsai et al’s (2015) research on the role of tablet computers in promoting digital inclusion for older people in the USA and Rosales et al’s (2017) study of the adoption and use of smartwatches by a small sample of older people living in Barcelona and Rome.

These studies present findings and conclusions relating to the processes of adoption and use of new technologies and the perceived benefits, challenges and risks associated with use of different ICTs that may be relevant to the development and delivery of services or interventions intended to maintain or improve social connectedness that are based on those ICTs. For example, based on the identification of frustration with self, computer equipment and/or learning experience as perceived barriers, Gatto and Tak (2008) highlight the importance of appropriate computer training and accessible support materials to the successful uptake of internet-based services or interventions.

Included articles

One way of considering the thirty-one articles included and evaluated in this review is by the type of technology or technologies primarily employed in the service, intervention or system reported in the publication. Table 6 sets out different potential categories of technology and identifies the included publications in which that category of technology was used in the

service, intervention or system. Table 6 also includes a category called 'Multiple-ICT', as some interventions seek to combine multiple types of ICT and these are perhaps best considered separately to reflect the additional complexity involved.

Table 6. Included publications by technology primarily employed in service or intervention

Category of technology	Publications reporting service / intervention where this is this is sole technology	Publications reporting technology as core part of multimodal service / intervention	Details of publications reporting service/intervention where this is this is sole technology (including indication of assessed quality of reported study, i.e. '(H)'=High, '(M)'=Medium, '(L)'=Low)
Telephone (landline or mobile)	1	0	Cattan et al (2011) (H)
Smartphone / tablet application ('App')	4	10	Barbosa Neves et al (2019) (M) Burmeister et al (2016) (L) Judges et al (2017) (M) Loi et al (2016) (M)
Internet-based information resource ('Info')	0	3	
Internet-based platform for text-based interaction (e.g. online support group, social media group) ('Online text')	1	12	Ballantyne et al (2010) (L)
Internet-based platform for audio-based interaction (e.g. Skype audio) ('Online audio')	0	9	
Internet-based platform for audiovisual interaction (e.g. videoconferencing) ('Online video')	4	6	Angelini et al (2016) (M) Banbury et al (2017) (M) Siniscarco et al (2017) (M) Tsai et al (2010) (M)
Other ('Other')	7	4	Baharin et al (2015) (M) Cortellessa et al (2018) (M) Hausknecht et al (2015) (M) Jobling (2014) (L) Sehrawat et al (2017) (L) Tsai et al (2012) (L) Wildevuur et al (2011) (L)

Category of technology	Publications reporting service / intervention where this is this is sole technology	Publications reporting technology as core part of multimodal service / intervention	Details of publications reporting service/intervention where this is this is sole technology (including indication of assessed quality of reported study, i.e. '(H)'=High, '(M)'=Medium, '(L)'=Low)
Multi-ICT services / interventions (n=14) (categories of technology used are given in brackets after indication of assessed quality of study)			Blažun et al (2012) (L) (Online text + Online audio) Boyd et al (2015) (L) (App + Online Text) Buhr et al (2017) (M) (App + Online Text) Coelho et al (2015) (M) (App + Online Text) Hasan and Linger (2016) (M) (App + Other (PC/laptop for gen use)) Botner (2018) (L) (Online text + Online audio + Online video) Garattini et al (2012) (M) (App + Online text + Online audio) Savolainen et al (2008) (M) (Info + Online text + Online video) Borrelli et al (2015) (L) (Online text + Online audio + Online video + Other (robotic system)) Delello and McWhorter al (2017) (M) (App + Online text + Online audio + Online video) McLaughlin et al (2012) (M) (App + Info + Online text + Online audio) Peter et al (2013) (M) (App + Online text + Online audio + Other (Ambient display; tangible device)) Zamir et al (2018) (M) (App + Online audio + Online video + Other (Mobile stand and handset for Skype videocalling)) Haritou et al (2016) (L) (App + Info + Online text + Online audio + Online video)

It is worth noting in relation to most of the types of technology employed in the studies included in this review that the equipment used in the studies is frequently less advanced than that which is currently commercially available and which could potentially be purposed to interventions to address social isolation. For example, 'voice assistants' such as Amazon's 'Alexa', Google's 'Google Assistant' and Apple's 'Siri' are not featured in any of the included studies. These products first became widely available around 2015, but these are now available built into dedicated devices, some with video capability, or incorporated into other ICT such as wireless speakers, mobile devices, wearable technology, e.g. smartwatches, etc. Their failure to feature in research included in this review is likely to be in part due to the delays between research studies being executed, reported and published, and included in bibliographic databases. Whilst not discussed here, interventions incorporating newer technologies such as voice assistants face similar challenges in relation to the effects of infrastructure (e.g. access to high speed internet connection or appropriate mobile telephone signals), 'digital divides' based on demographic and socioeconomic circumstances on equality of access, and the lack of practical guidance on implementation provided by the research evidence base.

Telephone-based services and interventions

The telephone (landline and mobile) is the longest established category of ICT given in Table 6, and yet only Cattan et al's (2011) high quality study reports an intervention using this category of ICT, suggesting a research preoccupation with primarily internet-based ICTs over the last 11 years. This research emphasis does reflect changes in ICT ownership and use over the last decade or so: reduced uptake of traditional landline-based services (from 90% of UK households in 2007 to 81% of households in 2018); increased uptake of smartphones (from 17% of UK adults in 2008 to 78% in 2018); and increased access to the internet (from 64% of UK households to 87%) and to either fixed or mobile broadband services (from 52% of UK households to 80% of households) (Ofcom 2018). However, these statistics mask differences in ICT access and use by different sub-populations, e.g. 95% of UK adults aged 16-24 use a smartphone but only 51% of those aged 55 and over (ibid.). It is therefore incumbent on developers of services and interventions designed to maintain or increase social connectedness to consider very carefully their intended user group and that group's access to and use of key ICTs.

Cattan et al's (2011) conclusions and recommendations still have resonance for both telephone-based services and interventions and those which employ voice over internet (VoIP) technologies which allow audio conversations online. Their analysis of qualitative data from the evaluation of eight UK-based telephone befriending services intended to provide low level support for socially isolated older people piloted in 2007-2008 found that telephone befriending services can help older people to: gain in confidence and self-respect; feel less fearful of facing health-related events alone; and request other services and activities which help them to re-engage with their communities. Cattan et al noted service users' preferences for receiving rather than initiating contacts with befrienders and for having choice of type of support. This publication highlights the importance of understanding the wider support context within which new services or interventions will operate and having mechanisms in place to point or connect users to existing services once interest has been stimulated.

Services and interventions based on smartphone or tablet computer apps

Four included publications reported on services and interventions based around smartphone or computer applications ('apps'), i.e. computer programs or software applications designed to run on these mobile devices. These studies variously evaluate training programs which aim to equip participants to use tablet computers for social connectedness (Burmeister et al 2016, Loi et al 2016) and consider the development of new apps which provide digital communications tools for specific older user groups (Barbosa Neves et al 2019, Judges et al 2017).

Burmeister et al (2016) report on an intervention designed to facilitate and increase opportunities for social connectedness for older people living in rural areas in Australia through a four-month program of technology training delivered by peer trainers, concluding that: ICT can enhance social connectedness for this population; peer support provides an acceptable and effective learning experience; and asynchronous communications, which give users a measure of control over the speed of communications, may particularly suit some user groups. Burmeister et al further suggest that ICT training for vulnerable groups and novice users should incorporate appropriate education about internet behaviours and online safety. By contrast, Loi et al (2016) found that a six-week facilitated training course

on using the internet and touchscreen technology for older adults with psychiatric disorders living in a residential setting had no significant effects on participants' social isolation and self-esteem, although participants enjoyed learning, acquiring new skills and discussing their experiences with others. **This divergence of findings highlights the need to fully understand what works, for whom, and in what circumstances.**

Judges et al (2017) evaluate 'InTouch', a multi-modal digital communication tool for use on tablet computers with an icon-based interface designed to be accessible to older users, finding that when combined with one-to-one support the app was perceived as easy to use and enhanced the frequency and quality of interaction with family and friends. As with Loi et al (2016), the authors also noted wider benefits for some participants, e.g. enjoyment of the learning experience, increased perceived self-efficacy for novice users. Judges et al highlight the importance to achieving social connectedness outcomes of understanding, and where necessary adopting strategies for increasing, intervention recipients' internal motivations to communicate. Testing an app with similar features with older Canadian retirement home residents, Barbosa Neves et al (2019) found that the app was a feasible tool for social connectedness but only where: the resident is given sufficient time to learn to use the app; one or more existing geographically distant connection to the resident is actively involved; any differences in the preferences, norms and expectations of the resident and their connection(s), e.g. regarding the timing and frequency of interactions, can be satisfactorily managed; and the resident perceives the app to be useful and functional, i.e. in comparison to other available methods of interaction with the person(s) with which they have a connection. Barbosa Neves et al's conclusions underline the need to test new services or interventions to understand the circumstances in which they will be optimally effective with the intended user group and highlight the importance of sensitivity to potential negative consequences of interventions: the authors noted that differences in preferences and expectations led to intergenerational tensions between participating residents and their social connections, and that the process of introducing the app 'seemed to augment feelings of inadequacy and awareness of frailty' for some participants.

Services and interventions using internet-based information resources

There were no included publications which detailed research into services or interventions based solely on internet-based information resources, although three papers (Savolainen et al 2008; McLaughlin et al 2012; Haritou et al 2016) incorporated this type of ICT into more complex multimodal services or interventions. These papers are discussed in the 'Multiple-ICT service or intervention' section below.

Internet-based platforms for text-based interaction

Although internet-based platforms for text-based services are a core ICT component in services or interventions reported in 12 of the 31 included publications, it is the sole ICT on only one: Ballantyne et al's (2010) qualitative study of the experiences of six older people with self-reported loneliness living in South Australia who received a three-month home-based one-to-one training intervention on the use of a 'About My Age,' an Australia-based social networking website specifically for people over the age of 50. The authors concluded that although there was considerable variability in individual outcomes, the intervention had the potential to provide an enjoyable learning experience, stimulate interaction with others also receiving the training, and reduce loneliness.

Internet-based platforms for audio-based interaction

None of the included publications discussed services or interventions which solely used internet-based platforms for audio-based interaction, but nine papers presented studies of interventions where this category of ICT was a component of a multimodal service or intervention (see 'Multiple-ICT services or interventions', later).

Internet-based platforms for audiovisual interaction

Four of the 31 included papers discuss services or interventions to maintain or increase social connectedness based solely on ICTs for audio-visual interaction, whilst a further 6 papers (discussed later in this review) present services or interventions where online video-based interaction is one of several ICT components.

All of the included papers based solely on this form of ICT discuss it in the context of older populations: Angelini et al (2016) report on the testing of a 'tangible interactive window' simplified audiovisual interface with older adults; Banbury et al (2017) ask whether videoconferencing can affect older people's engagement and perception of their social support in long-term conditions management; and both Tsai et al (2010) and Siniscarco et al (2017) look at videoconferencing as an intervention for maintaining and improving social connectedness in long term care.

Angelini et al's (2016) 'tangible interactive window', which physically mimics a window through which users converse, provides what the authors believe to be 'natural interface for an always-on video-communication system'. Tested with residents of a Swiss nursing home, the authors concluded that: the device was acceptable to users and the service feasible in care homes; the window metaphor allowed users to intuitively understand how to use it; and the natural size of the image on the large display gave participants a sense of genuine proximity to the person in the remote room. Angelini et al felt that with further development, the device had potential to counteract social isolation for older people living alone in the community. As with other included studies across a range of categories of ICT, Angelini et al's research highlights concerns about the need to provide communications interfaces that are intelligible to and usable by intended populations and with the sustainability of services or interventions which require interacting parties to acquire and learn to use new devices.

Banbury et al (2017) used a mixed methods approach to test the effect of a 5-week program of weekly group videoconference meetings on older Australian participants with long term health conditions living in the community. Tablet computer-based videoconference equipment was provided for the study and meetings consisted of health information presented via slide presentations and videos followed by facilitated discussion and sharing of opinions and experiences. There was considerable individual variability in outcomes, but an increase in participants' average social network size. Groups with more consistent membership reported better peer support-related outcomes and more sustained new connections. Online audio-visual interaction was viewed as preferable to telephone interaction or no social interaction (which was the case for many participants much of the time) Participants valued the social aspect of the online meetings as much or more than the receipt of health information. **This study provides evidence that using ICTs to create stable groups with members who have more specific common interests may be more effective in increasing social networks than where the same ICTs are used to bring together**

fluctuating groups of individuals from more general populations, e.g. ‘older people’, who may have less in common.

Tsai et al (2010) and Siniscarco et al’s (2017) studies are broadly similar in terms of the central ICT (videoconferencing) and intervention target population (people in long term care). Tsai et al evaluated a videoconference program intervention delivered to residents of Taiwanese nursing homes in which participants were assisted to hold weekly videoconference calls of five minutes or more with a participating contact family member using MSN or Skype. Program recipients had significantly lower mean levels of depressive symptoms and loneliness after 3 months than a matched control group. Tsai et al highlighted the need to: observe how results would be affected by a longer intervention period when any ‘novelty’ effect would have worn off; explore the relative effectiveness of telephone, in-person and videoconference contacts with family members; investigate the acceptability of the intervention in different cultural contexts which may emphasize expression of care through in-person visits; and understand the meaning of family visiting in Chinese society and the extent to which ICT-mediated contact might change this.

The paper by Siniscarco et al (2017), published 7 years later, acknowledged Tsai et al (2010) as the largest study of the use of videoconferencing in long term care to improve affective wellbeing, but suggested that previously published studies had identified a range of barriers to more positive outcomes so the full potential of the technology to deliver outcomes was still not known. Their study piloted an Asus tabletop videoconferencing machine using high-speed internet connection with residents of a US-based multi-level long term care facility and their nominated family members or friends, who called the participating residents a minimum of once per week for two months, with both members of each pair free to initiate additional calls. Low participant numbers limited findings, but data suggested that participants found the equipment reliable and easy to use, and had enjoyed the experience of videoconferencing with their close contacts. Siniscarco et al observed that barriers to use noted in the literature (particularly loss of Wi-Fi signal when devices were moved, need for ongoing participant support to overcome intimidatory effects of technology and unfamiliarity with the interface, and challenges reconciling the different needs and availability of pairs of participants) still remained.

Siniscarco et al present a series of recommendations for future practice and research which include: selecting portable, durable and where possible familiar hardware (they noted the increasing ubiquity of smartphones and tablet computers); using hardware and/or videoconferencing platforms which provide features which disable communications at night; ensuring adequate access to high-speed internet services; considering supported communal devices located centrally, e.g. at the nurses’ station, in preference to individual devices for all residents; identifying mutually convenient times for calls between residents and their contacts ahead of implementing any service of intervention; piloting services prior to full implementation to ensure an acceptable match between potential users’ levels of cognitive ability and the support likely to be available from staff.

Other technologies

A total of 11 included papers relate to services or interventions incorporating ICTs which were categorised as ‘Other’. In seven of these, this ‘other technology’ was the sole ICT: Baharin et al (2015) report on pilots of ‘an ambient awareness technology probe designed to connect users’ ‘soundscapes’; Cortellessa et al (2018) describe trials of an enhanced

telepresence robot named ROBIN; Hausknecht et al (2015) detail outcomes from a Wii Bowling tournament; Jobling (2014) describes the work of the San Francisco-based Community Living Campaign (CLC), including delivery of a computer training program; Sehrawat et al (2017) discuss participatory-action research on an intergenerational digital storytelling project; Tsai et al (2012) present Sharetouch, an optical touch device capable of supporting multi-touch functions within a large table-top display; and Wildevuur et al (2011) report on initial testing of 'Scottie', a system designed to establish social connectedness between users through non-verbal, implicit communication through colour and sound, thereby stimulating a feeling of social presence at a distance that can contribute to (social) wellbeing.

A further four publications detail the use of 'other technologies' as part of multi-component ICT services or interventions to address social connectedness. These were: an assessment by Hasan and Linger (2016) of the impact of 'computer kiosks' and training on the social use of ICT in care homes for older people; Borrelli et al's (2015) paper on a prototype robotic device with functions including providing users with access to online communications modalities; an evaluation by Peter et al (2013) of a pervasive computing system which includes a 'tangible device' and 'ambient display' as interfaces for interactions; and Zamir et al's (2018) exploration of barriers to implementation of a 'Skype on Wheels' mobile videoconferencing device in short- and long-term care environments. These are discussed in detail later, in the section on multi-ICT services and interventions.

The studies by Baharin et al (2015) and Wildevuur et al (2011) share a common interest in the use of novel non-verbal interfaces for non-verbal communication which may promote a sense of connectedness. Although preliminary, the results of initial testing suggest the potential for such interfaces to form a part of future services or interventions designed to maintain social connections at a distance for different populations.

Tsai et al's (2012) paper also presents technical details of a novel interface for ICT-mediated simultaneous interaction by multiple older users: Sharetouch. The Sharetouch system (internet-enabled PC-based controller, optical touch device and 52inch LCD display) is mounted into a table to provide a large horizontal touch panel for ease of operation by older users in a familiar housing which may help to ameliorate the effects of any user preconceptions about complexity of or self-efficacy in using ICTs. The system incorporates specifically developed 'community pond' social network display, 'Waterball' interactive game and multimedia sharing apps designed to stimulate interest in different forms of interaction. User validity testing with older residents of a Taiwanese senior housing found that whilst older participants had lower expectations of self-efficacy or enjoyment in using the system prior to using it, participants generally found it easy to use, saw it as a useful support to social interaction, and would use it again if it was available to them.

The publication by Cortellessa et al (2018) describes a study to assess the multimodal interaction capabilities and communications services provided by 'ROBIN'. An integrated component part of the 'GIRAFFPLUS' telecare system, ROBIN is an enhanced telepresence robot which allows formal and informal carers to remotely communicate with the person being supported also designed to support social interaction and provide motivational feedback to users. ROBIN provides older users with enhancements to synchronous interaction and extended capacity for asynchronous interaction. Cortellessa et al's study was concerned with evaluating ROBIN in terms of the cognitive workload associated with

operation, affective responses to robot technology, perceived usefulness, and emotional reaction to human-robot interaction. The authors found that: participants were generally positive about interactions; the tasks resulted in minimal cognitive load; openness to new experiences generally was associated with lower risk of perceiving interaction with robots negatively. These findings support the authors' conclusion that personality traits and other individual differences may be important variables in fostering acceptance, compliance and trust in human-robot interaction.

In the interventions described in papers by Hausknecht et al (2015) and Sehwat et al (2017) ICT-enabled activity provides a mechanism to bring together individuals, creating opportunities for increasing social connectedness. Hausknecht et al evaluated the sustainability of social benefits derived from older people's participation in an 8-week Wii Bowling tournament held in a city in western Canada. Older people were recruited from seniors' centres and other facilities with scheduled activities across the city to make 20 teams of 3-4 players, with data collected immediately post-tournament suggesting that players experienced increases in social connectedness and reductions in loneliness as a result of participation. The authors found that three months later whilst many individuals continued to play Wii Bowling or meet other members of their team socially and maintain the new social contacts made during the tournament, sustaining the teams that played in the tournament without organised match schedules was challenging and when for whatever reason a player withdrew it was often hard to recruit new members to existing teams due to perceived disparities in skill levels and individual reluctance to join teams whose other members already knew each other well.

Sehwat et al's intergenerational intervention paired US college students with technology and writing skills and older people to co-create a digital story which focused on a moment in the life of the older partner and subsequently sharing the stories with the larger group and project partners. Older participants reported increases in social network size and social interaction prompted by sharing their digital stories more widely with friends, family, other participants and wider intergenerational audiences, leading the authors to call for more research on the potential of digital stories as a vehicle for improving social connectedness and creating intergenerational bonds.

Finally, Jobling (2014) describes the delivery of a computer training program by the San Francisco-based Community Living Campaign (CLC), the purpose of which was to overcome obstacles to computer accessibility for older adults living in the San Francisco area. The paper does not present a rigorous evaluation of the program but discusses its development and highlights important practical considerations. The author, an executive director of CLC, asserts that her organisation has 'seen firsthand how technology can play a critical role in creating and multiplying social ties' (2014: p48) but also identified access-related issues as a fundamental obstacle to its use by older adults and people with disabilities. To motivate learning, the program began with asking participants what they would like to accomplish using computers and to encourage sustained attendance it included a monthly session for participants to bring in their computer equipment for free technical support.

Interventions or services incorporating multiple categories of ICT

In this section, the 14 publications included in the review relating to services or interventions incorporating multiple categories of ICT are, in general, presented and discussed in order of increasing number of ICT categories incorporated into the service or

intervention (see Table 6 for details of included ICT categories). It is worth bearing in mind that in more complex interventions it can be difficult to tease out the relative contributions of individual elements to reported outcomes and to fully understand variation in outcomes.

Four included papers discuss studies of or provide technical descriptions of services or interventions to maintain or improve social connectedness which incorporate text-based interaction with one other ICT category: Blažun et al (2012) discuss the impact of computer training for older people to enable online text and audio interaction, and Boyd et al (2015), Buhr et al (2017) and Coelho et al (2015) discuss interventions based on a combination of smartphone or tablet computer application and online text-based interaction.

Blažun et al's (2012) comparative study of the impact of computer training courses on reduction of loneliness of older participants in Finland and Slovenia found that outcomes could be affected by a range of personal characteristics and demographic variables. In addition, previous ICT experiences may affect older people's levels of engagement with ICT and by extension the efficacy of ICT-based interventions. Ballantyne et al's (2010) study, discussed earlier in the review, highlights the role of consistent and ongoing support in achieving positive outcomes and the authors noted that volunteer trainers would be needed to ensure sustainability of such a resource-intensive intervention.

Text-based SNS are widely believed to have the potential to help users maintain or increase levels of social connectedness, e.g. Burmeister et al (2016) have suggested that asynchronous interaction, i.e. where there is a delay between receiving and responding to communications giving the user more control over timing and the flow of interactions, might suit some older populations. Rather than create entirely new networking platforms, a number of studies (e.g. Boyd et al 2015, Coelho et al 2015) have sought to develop and test simplified interfaces which might encourage individuals to use existing social networking platforms, arguing that this would improve take-up by some groups of socially isolated individuals. Boyd et al (2015) compared ease of learning and use of Facebook and EasiSocial, a web application which displays Facebook in a manner considered more suitable for older people. Findings suggested that EasiSocial was statistically easier to learn and to use.

Coelho et al (2015) reported findings from a study of the development of prototype simplified Facebook-based interfaces for use by older people on smart TV and tablet computer, ICTs that the author suggest are more 'elder friendly'. The prototypes were suggested to facilitate user interaction by offering a range of modes of interaction to complement text, e.g. use of remote controller functions, speech and gesture for the TV interface and touch, gesture, speech and tilting or touching the device for the tablet computer interface. Coelho et al concluded that older people were potentially receptive to using social networking platforms via TV and tablet computer interfaces, although current non-users had concerns around privacy, online security and the behaviours of current users leading to reservations about the use of Facebook as a specific SNS.

These studies serve to highlight the need for developers of services or interventions for social connectedness that are based on social networking platforms to consider both the interface needs of their target groups and members' perceptions of social networking in general and of specific SNS in order to maximise uptake of the service or intervention.

In their study of the development and testing of AphasiaWeb, an iPad-based social network app designed for people with aphasia, Buhr et al (2017) argue that such control is a

'critical step towards facilitating social participation among individuals with aphasia' but that the poor site designs and overly complex interfaces of common social networks limited access for this group. Most of those testing AphasiaWeb already interacted with friends and family via Facebook but welcomed the availability of an additional closed-access platform for peer support and mutual understanding of living with aphasia. Buhr et al suggested that such platforms might be helpful for maintaining social connections where people also or initially met face-to-face, and that with additional platform accessibility features, existing generically available apps could potentially address desires of people with different health conditions to both interact with peers and connect to individuals without their condition.

Hasan and Linger (2016) describe a 2-year action research project to design and implement interventions to enable and encourage the use of ICT among residents of care facilities for older people in Australia based on the provision of 'computer kiosks' stocked with second-hand laptops, iPads and wifi hubs and weekly training sessions were provided by volunteers. Efforts were made to create a fun and relaxed environment in which participants could choose the device that best suited them, set their own learning agendas, learn at their own pace and laugh at their mistakes. The authors found that their interventions provided participants with access to devices and the opportunity to gain or extend ICT use skills and use these to achieve personally meaningful activities. The authors note that 'we realized that the main contribution to the wellbeing of our participants **was not how well they use ICT, but what they used it for**' (2016: p756) and conclude that different ICT uses can contribute to older people's social wellbeing through contributing to one or more key themes which describe dimensions of wellbeing: connection; self-worth/esteem and personal development; productivity; occupation; self-sufficiency; being in control; and enjoyment.

Three included papers present research on into more complex multimodal services or interventions which incorporate internet-based information resources and one or more online modes of interaction: Savolainen et al (2008), McLaughlin et al (2012), and Haritou et al (2016).

Savolainen et al (2008) report on an evaluation of the Swedish ACTION (Assisting Carers using Telematic Interventions to meet Older people's Needs) service, designed to enhance the independence and quality of life of frail older people and their family carers through the provision of a PC-based integrated web-based multimedia and video communication systems which enable users to contact callcentre-based nursing staff and receive help, support and practical advice on managing their lives and use the equipment to access the internet, relevant online information resources, and email for formal health and social care and personal social purposes. The authors concluded that: there were significant and unexplained individual differences in the frequency and length of use of the ACTION videophone; the evaluation did not capture the importance to users of calls made, or the perceived benefit of having this facility available; experienced and relatively frequent users felt happier and were more socially connected through use of the system, but no data were available on less experienced or frequent users.

Universally available platforms may not always meet the accessibility or content-related needs of specific user populations. However, one of the risks of developing a novel, more targeted service is that there may be insufficient demand to allow it to be successfully made more widely available. In two of the studies in which online information resources were a

core ICT component, McLaughlin et al (2012) and Haritou et al (2016), app-based multimedia platforms provide access to the internet-based information resources and selected online tools for asynchronous and synchronous online communication. It is not clear that either of these platforms was made generally available outside of its development stage.

McLaughlin et al (2012) detail piloting of 'LIFECommunity', a social networking and videosharing platform tailored specifically for young adult cancer survivors, finding that individuals with lower levels of social support from friends and family and weaker family interaction participated more in the LIFECommunity network and that pre-existing offline bridging ties with other cancer survivors was highly predictive of network use.

The publication by Haritou et al (2016) relates to a pilot study with participants from the UK and Poland of 'Going online: my social life' (aka 'Go-myLife'), a context-aware social networking platform adapted to the needs of older users. Haritou et al found that as a 'gateway platform' helping older people to use existing SNS rather than creating new ones, the Go-myLife platform was able to successfully facilitate connection between users, their neighbourhoods and relevant local businesses and services. Users felt safe and, relative to other social media platforms, Go-myLife inspired greater trust and perceived reliability. Haritou et al make the point that as many members of Go-myLife's target population have already invested time and effort in building contact lists and relationships on popular SNS, it was important for the new platform to complement rather than compete with existing services.

Four of the remaining papers discuss the inclusion of internet-based platforms for multiple modes of online interaction as a component part of a complex service or intervention to maintain or improve social connectedness and present small-scale feasibility, usability or pilot studies of systems still in development. These are: Garattini et al's (2012) pilot study of a prototype tablet computer-based communications system; Peter et al's (2013) evaluation of a home-based system with components including a sensor-equipped home system, ambient display, tangible device, mobile phone and smartwatch; Borrelli et al's (2015) developmental research and lab-based user testing of an integrated robotic system based on an existing platform; and Zamir et al's (2018) implementation of a 'Skype on Wheels' system for use in care homes and hospitals.

The preliminary nature of the studies means that they do not contribute greatly to the evidence base on the effectiveness of these types of intervention in maintaining or enhancing social connectedness, but they do provide insights into the feasibility and acceptability of different types of ICT to the target populations which might be of value to those looking to develop new services or interventions.

The prototype 'Building Bridges' communications system described and piloted by Garattini et al (2012) incorporates a touchscreen tablet computer which sits in a purpose-built stand and to which a VoIP-enabled telephone handset with functional cradle and speakers is attached. A customised interface developed in collaboration with older people provides access to four main features each leading to opportunities for either text-based or audio-based interaction. The system was tested over 10 weeks community-dwelling older people living in Dublin. Garattini et al noted variability in use across participants, identifying gender and level of social loneliness as characteristics influencing system use. In common with Buhr

et al (2017), Garattini et al's participants suggested that system use would be enhanced by initial or ongoing face-to-face meetings between users. The broadcast feature was most successful in prompting online interaction where the content was informative or educational and perceived by users to be relevant to them.

Peter et al (2013) evaluated AGNES, a sensor-equipped home-based system providing a pervasive and multimodal approach to technology mediated interaction employing networked ICTs and using dedicated 'non-traditional' interfaces (specially developed tangible devices and ambient displays which communicated basic messages) to prompt and support social communication between older people, their families, friends and others significant to them (e.g. formal health and care services). The AGNES system incorporated multiple devices for collecting data from which to infer users' emotional and activity-related states and allowing users to use the system to interact with others. Peter et al (2013) found that the AGNES system successfully detected less subtle physical and emotional states of users, that users found the interfaces not PC-based to be useful, and that the combination of tangible and wearable devices and ambient displays allowed users to interact with the network without use of a PC.

Borelli et al (2015) reported on lab-based testing of 'OMNIAROBOCARE', which the paper describes as 'a robotic system to ease loneliness and foster socialisation'. The system is based on the OMNIACARE platform, which provides real time remote monitoring of users' health status. The 'OMNIAROBOCARE' platform integrates OMNICARE functions and a tablet PC for social activities into an ICT robotic platform which incorporates wireless internet connection, and motorised sensor-based navigation and movement capabilities. Borelli et al report that participants involved in early laboratory-based testing saw potential for the system to allow users to maintain social connections. It is not clear whether development continued beyond the 2-year lifetime of the research project.

Zamir et al (2018) presented the results of a collaborative action research project evaluating the implementation of 'Skype on Wheels' (SoW), a device integrating a tablet computer on an extendable arm and a telephone handset and cradle attached to a vertical strut on a wheeled base to allow the device to be easily moved into position to provide a free video-call. The authors were particularly concerned to identify barriers to and facilitators of implementing such systems in care environments. Identified barriers to implementation included: staff turnover, which led to use of SoW not being sustained; care staff risk averseness; device design issues, e.g. concerning appearance to potential users, small screen, poor sound quality using handset; need for commitment by users' contacts; staff attitudes to implementation, perceived lack of training in use of equipment. The authors concluded that it was necessary to understand how to optimise engagement with the device before it was possible to evaluate its effectiveness in reducing social isolation.

The final two papers discussing the inclusion of internet-based platforms for multiple modes of online interaction as a component part of a complex service or intervention to maintain or improve social connectedness, Botner (2018) and Delello and McWhorter (2017), both discuss the potential for ICT to increase social connections when used in educational contexts.

Botner (2018) presents a practice perspective on 'The Virtual Learning Program' ('VLP'), a service intended to address social isolation of older English-speaking residents of Quebec

(who represent 6.8% of all older residents of Quebec), Canada, through providing online access to lecture and event programming at the Cummings Centre, a non-profit community centre for older people based in Montreal. The VLP provided home and telephone-based support from older adult volunteers and access to webcasts, video on demand services and online discussion groups over a 27-month period. Botner, who was a program manager at the Cummings Centre, noted a number of practical challenges with the VLP. Recruiting and retaining VLP participants was problematic, with a particular drop-off in participant usage following a change from weekly to monthly programming. Participants needed additional technical support and a short instruction manual was produced to supplement support from volunteers. There were significant costs to the Centre generating and hosting online content. Botner concluded that it was important to sustaining online social connection that participants felt part of a virtual community. **Botner's paper is notable for being one of a small number of discussions included in this review of an available service. The insights offered around the effects of frequency of intervention, the need for ongoing recruitment with older populations, and the importance of developing a sense of community to aid retention will be of particular value to developers of new services and interventions for social connectedness**

Delello and McWhorter's (2017) study was particularly concerned with evaluating the impact of learning to use iPads on older people's metaliteracy and sense of community. As portable devices with large buttons and an easy-to-use graphical interface, iPads are often assumed to be a more accessible form of ICT for older people, but the authors wanted to understand what special adaptations might need to be considered when working with older people as they learn to use this technology. Evaluation of a 6-week training programme found that participants significantly improved their iPad competency levels and most wanted to continue having weekly iPad training in the future. They made internet-based connections with family members and other residents of the retirement community as well as new connections with other participants. Participants identified reduced speed of learning and memory difficulties as factors which impeded their progress in the training and required adaptations to the program, e.g. increased time for practice and greater use of visual aids in training sessions. This study highlights the ways in which the provision of small group training on ICT can both create new connections and give recipients the confidence to use online services to maintain and increase social connectedness, a finding which has been highlighted by other included studies.

Key messages

There is a significant body of evidence of a positive relationship between current ICT use and social connectedness, i.e. people who use ICT and internet-based communications more tend to be more socially connected. However, this is primarily based on data from cross-sectional surveys and gives no indication of causality, i.e. whether people who use ICT and internet-based communications more *become* more socially connected as a result of that use.

The evidence base is underdeveloped: relatively few papers have been published since 2008 which explore or evaluate ICT-based or ICT-enabled services or interventions designed to maintain or increase social connectedness.

Most included studies do not employ robust controlled trial research designs but have research designs with important or major limitations as reported. Fourteen of the services or interventions described in included publications integrate two more categories of ICT. Intervention complexity can mean that it is more challenging to fully understand the relative contributions of different elements to any beneficial outcomes and thus to optimise user benefits.

Older people (often frail older people or older people with long-term health conditions) are the target user population for the services or interventions described in 28 out of 31 included publications, reflecting concerns that older people are more at risk of becoming less socially connected. There is evident recognition of the need to provide interfaces for interaction which are accessible to intended users of ICT-based or enabled services or interventions, and responses to this need in the research literature range from the provision of simplified platforms for online social network services to the development of new modes of interaction and novel devices and interfaces for user input or output display.

Many publications present small-scale feasibility or pilot studies of innovative systems and devices with small numbers of participants who are in some cases not drawn from the population for which the service or intervention is intended. It is not therefore clear to what extent observed outcomes would be replicated in the target population.

Cross-sectional studies suggest the existence of 'digital divides' in ICT use, e.g. in relation to age, employment status / occupation, household income, education (number of years, attainment levels), but the implications of these are rarely discussed in literature on the testing of services or interventions. Included studies note unexplained individual differences in the uptake and use of some ICT-based services or interventions which need to be explored further. Several studies have hinted at the potential importance of personality traits in explaining such differences and this needs to be explored empirically.

There is insufficient evidence available to make strong recommendations in relation to the efficacy of most ICT-based or enabled services or interventions to maintain or increase social connectedness and insufficient evidence to identify what services or interventions will work best for whom and in what circumstances.

Research design affects the confidence which can be placed in the conclusions or recommendations of studies. Researchers should consider ways in which the design of studies can be made more robust, e.g. through larger studies with participants sampled from the intended user population.

Despite weaknesses in the evidence base, it is still possible for insights from individual studies to inform the design and implementation of new services and interventions although some practical aspects and user-centric issues appear to have received little attention in this literature.

Technology scoping

From the technology scoping exercise, we identified 76 examples of technology being used to support social connectedness. Of these, 52 were examples of technology being used in practice, 17 related to technology interventions delivered within research projects, 2 involved research and practice and 4 are reviews of technology projects provided by people with dementia. **The majority of examples were for technology to be used at home (57) and in the community (20) with just 8 based in care settings although some examples were used in more than one setting.** The technology used had four main aims that related to social connectedness:

- entertainment (22),
- communication (44),
- direct social interaction (58)
- task orientated activities (18).

For almost all projects we are able to provide a website or publication that offers more information about the projects. The dataset demonstrates a wide range of uses of technology to promote social connectedness.

Some types of activity were found multiple times. One of these was the provision of training in the use of IT and the Internet. This type of training provided adults with opportunities to increase social connectedness through the use of email, Facebook and other apps and websites. The scoping suggested many examples of this type of activity with different age groups of adults. The final version of the database includes just a sample of these projects.

Examples of innovation

Six examples are given here that illustrate the breadth in the use of technology to support social connectedness for people of different ages and with different circumstances. More information and weblinks are included in the dataset that can be accessed through the links in the 'Guidance' section of this report.

Database entry 19: Run by the RNIB, the telephone book clubs bring people of all ages with sight loss together with volunteers and sometimes guest speakers, including authors, to discuss books. This provides new opportunities for social connection.

Database entries 25 – 28: These entries present information from Alzheimer Scotland's technology panel where people with dementia and their family carers test out different technologies and provide real life, practical reviews of the technology. While not all technologies are promoting social connectedness the examples included on the database are different communication devices.

Database entries 55 and 56: These two apps, *Far, far away* and *Caribu* provide resources and a videoconference link to encourage and enable family members to read bedtime stories to children in their family who live at a distance from them. These are freely available, straightforward to use and promote social connectedness for family members.

Database entry 64: *Happy the movement* is an app that allows people to connect with and speak to trained 'compassionate listeners.' This app has a direct intention to increase social

connectedness for people who may be experiencing isolation and loneliness due to particular circumstances in their lives.

Database entry 68: This entry provides several examples of targeted social networking and dating sites for people over 50 supporting people of different ages to access online communities and support social connectedness.

Database entry 69: *Mobile age* app, this is an app for older people living within a locality in northern England that supports them to get out and about and engage socially by providing practical advice and links to information about local transport, (e.g. bus stops and car parks), public toilets and benches. This application is particularly interesting as it has been developed using a participatory approach with older people and it offers practical advice at a local level.

Notes on the technology scoping findings

It is important to note that, as with technology itself, the products and interventions included in the technology scoping dataset are constantly changing and up-dating, and while all the weblinks were checked in July 2019 we are aware that many links will not continue to remain live over time. **For those who are interested in checking what is going on we would advise an initial review of our dataset but also would recommend conducting your own online searches using search terms such as ‘connectedness and technology’ or by using the search terms outlined above and in the literature review methods section.** You could also try searching for the organisations included in our dataset.

A note on social robots: While undertaking the technology scoping exercise we came across examples of so-called ‘social robots’, and these examples remain on the database. However, following review of these examples we made a deliberate decision to exclude social robots from the subsequent stages of the project. While there were examples of robots used in different ways we felt that when a robot was playing the part of the ‘other’ (i.e. substituting a human other) in an interaction this could not be considered social as it was not promoting connection with another human being. Technology described at robots but that did facilitate connection with another person, including virtual assistants such as Alexa, were still included as they can be used to facilitate connection with other people and their purpose could also be to provide information.

The examples included in the dataset have not be subjected to a quality assessment in the way that has been undertaken for the articles included in the literature review. The dataset is intended as a starting point for understanding the ways in which technology is being used and to demonstrate the diversity in the ways technology has been and can be used. The dataset provides a springboard for brainstorming ideas and understanding what might be possible, rather than a set of recommended projects and technologies.

Key messages

Technology of different types is being used in many different ways to support social connectedness. Most technologies being used in this way are intended for people living at home although there are technologies in use and in development for the care home sector.

Many positive outcomes are reported online about the use of technology to support social connectedness but the empirical evidence base is small, as reported further in the literature review findings.

It is important to consider the quality of information provided online and consider whether evaluations have been undertaken of particular devices or interventions and whether findings have been published in academic journals or other reputable sources.

Technology and ways of using technology evolve very quickly and information soon goes out of date, it is important to check for up-to-date information.

The technology scoping dataset is intended as a resource for generating ideas and discussion, it is not intended as an evidence base for best practice.

HAGIS data analysis

HAGIS Sample

Of the total HAGIS sample, 685 respondents answered the questions on social connectedness and technology use. Of these 55% were women, 65% were aged between 60-79 years, 66% were married or living with a partner, and 67% were retired. For further details of the sample please see the HAGIS supplementary material, available here [add hyperlink].

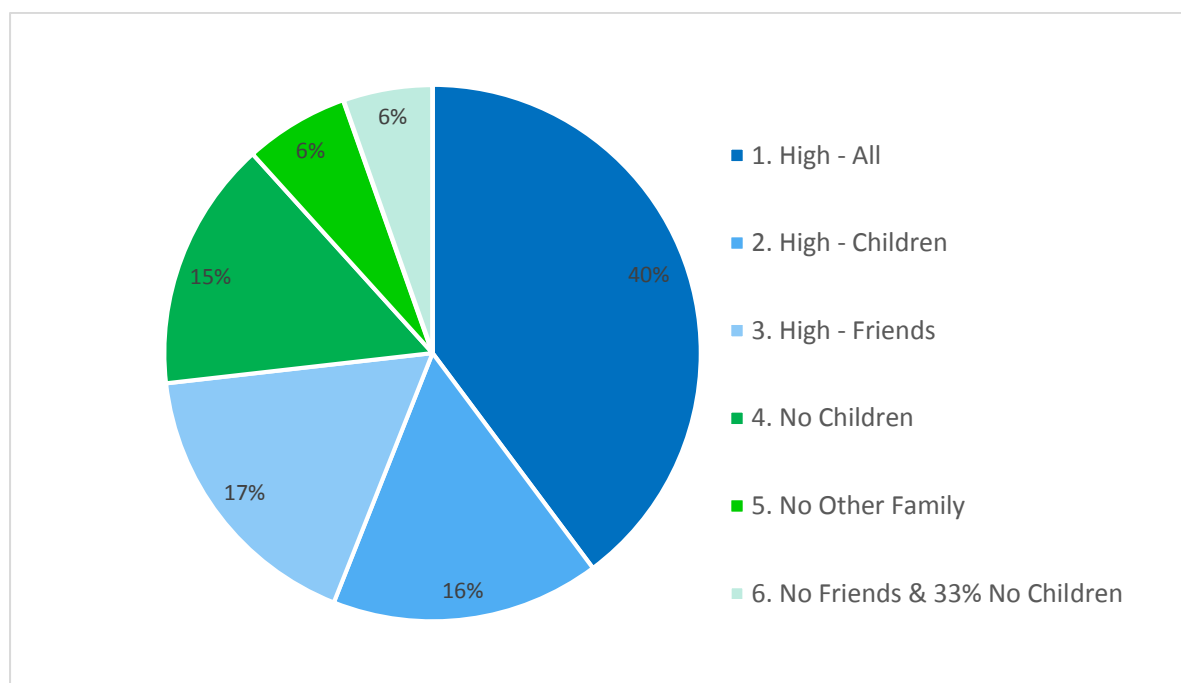
Profiles of Social Connectedness

We identified 6 distinct profiles based on those who were in contact with their children, friends or other family more than once per month (see Figure 4). The vast majority (73%) of people have regular social contact with children, friends, or family.

Broadly, these profiles fell into two categories according to those who had:

- **Contact with all groups (73%):** children; friends; and other family (blue shading)
 - Profile 1: High connection with ALL – 40%
 - Profile 2: High connection, particularly with Children – 16%
 - Profile 3: High connection, particularly with Friends – 17%
- **No contact with *either* children, friends, or other family (27%):** (green shading)
 - Profile 4: No Children – 15%
 - Profile 5: No Other Family – 6%
 - Profile 6: No Friends – 6%

Figure 4. Profiles of Social Connection



The frequency of contact with children, friends and other family, either as a meeting or via phone, email, or text, are shown in Figure 5.

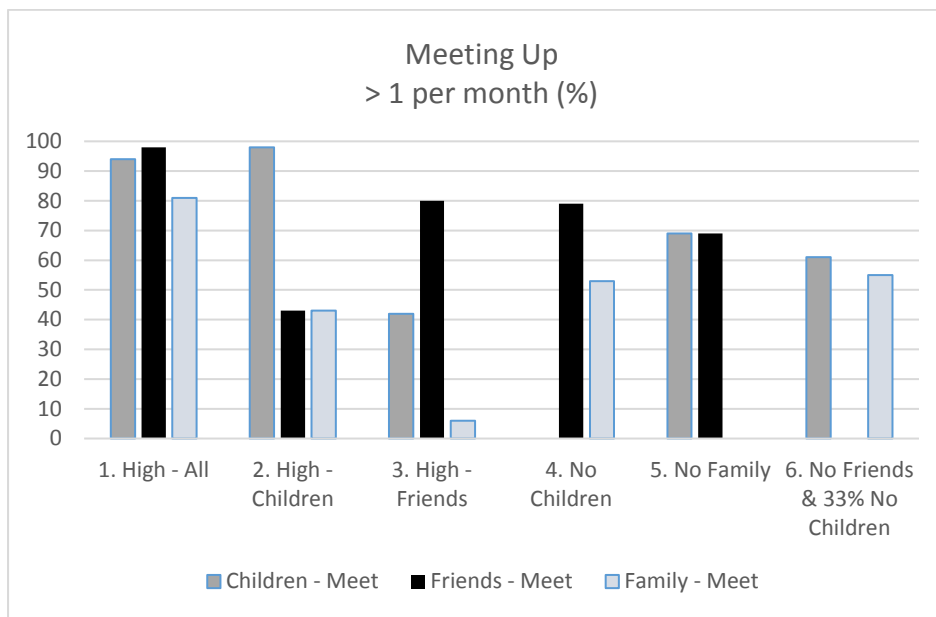
- Profile 1, named **High – All** (n=245, 40%), have frequent contact with all groups (children, friends, and family). That is, over 90% are in contact with all more than once per month.
- Profile 2, named **High – Children** (n=100, 16%), more than 95% contact their children (meeting and via phone/email/text) more than once per month. Around 40% meet with friends and other family once per month, and where contact via phone/email/text is more common.
- Profile 3, named **High – Friends** (n=106, 17%), more than 80% contact their friends (meeting and via phone/email/text) more than once per month, and are in touch with their children by phone/email/text. However, fewer people in this profile contact their children (meeting) and other family more than once per month.
- Profile 4, named **No Children** (n=93, 15%), around 80% are in contact with their friends (both meeting and via phone/email/text) and phone/email/text their other family. Everyone in this profile have no children.
- Profile 5, named **No Family** (n=39, 6%), almost 90% are in contact with their children via phone/email/text more than once per month, and around 65% meet their children and friends, or contact their friends by phone/email/text, more than once per month.
- Profile 6, named **No Friends** (n=33, 6%), 63% and 78%, respectively, contact their children or other family by phone/email/text and fewer will meet with their children or other family more than once per month. One third of this group do not have children which indicates that those who do have children represent those in touch with their children, and therefore that they have frequent contact with them.

How do older people stay in touch with each other?

Meeting Up

Meeting up with children, friends, and family varies quite considerably across the Social Connection Profiles (see Figure 5). More than 90% of those people who are highly connected with everyone (Profile 1) meet up their children and friends, and 80% meet other family, more than once per month. 98% of those with high connections to children (Profile 2) meet up with their children more than once per month, but only 40% meet with friends or family to the same extent. For those with high social connections with friends (Profile 3) and those without children (Profile 4) 80% meet with friends more than once per month, but meet with other groups less frequently. However, for Profiles 2 and 3, frequent meetings with children or friends contrast with infrequent contact with other social groups. Around 70% of those with No Family (Profile 5) and around 60% of those with No Friends (Profile 6) meet with other people more than once per month.

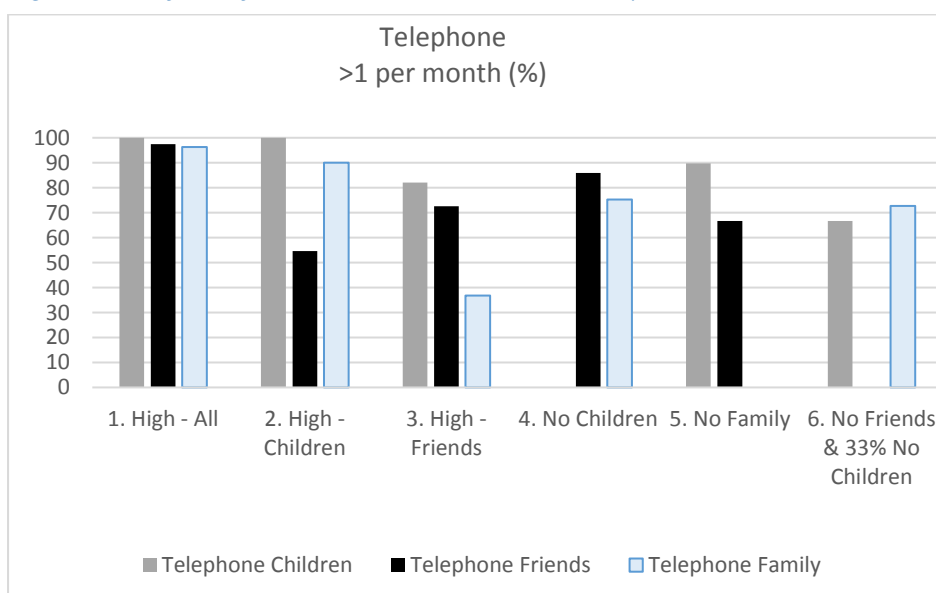
Figure 5. Profiles of Social Connection and % Meeting > Once Per Month



Telephone Contact

Telephone contact is the most frequently cited form of communication across all profiles (see Figure 6). Profile 1 has most frequent telephone contact with all social connections, and Profile 2 has frequent telephone contact with both children and other family. More than 60% of Profiles 3, 4, 5, and 6 are in frequent telephone contact with other social connections, with the exception of Profile 3, where around one third telephone other family more than once per month.

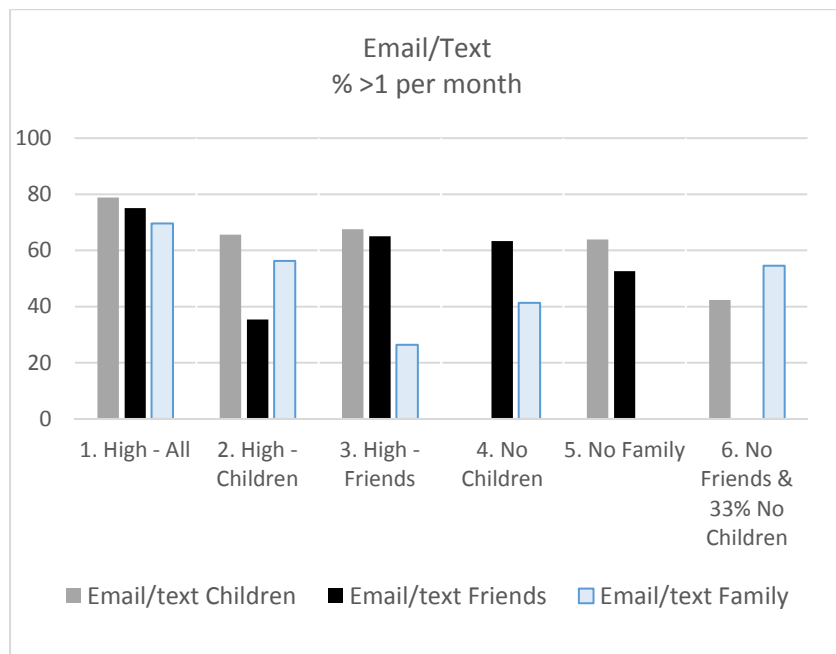
Figure 6. Profiles of Social Connection and % Telephone > Once Per Month



Email or Text

Contact by email or text is the least frequent means of communication across all profiles (See Figure 7). However, more than 60% of all profiles used this method of communication to keep in touch with others. Profile 6 (No Friends) were least likely to contact by email or text.

Figure 7. Profiles of Social Connection and Email/Text Contact



Socio-demographic Characteristics of the Profiles

We then looked at the sociodemographic characteristics of each profile (see Figure 8). This is useful to help us to understand more about the who in the population is most likely to belong to each of the profiles.

Profile 1: High connection with ALL – 40%

- 62% are **women**
- 70% are **60-79 years**
- 70% are **married/living with partner**, and 29% are divorced, separated or widowed
- Highest level of education was spread broadly across all groups, however 39% had high school and 24% have higher education qualifications
- 71% are **retired** and 25% are working

Profile 2: High connection, particularly with Children – 16%

- 64% are **women**
- 65% aged **60-79 years**
- 74% are **married/living with partner** and 24% are divorced, separated or widowed
- For 72% their highest level of education is **none/primary or secondary school qualifications**
- 67% **retired** and 26% working

Profile 3: High connection, particularly with Friends – 17%

- 56% are **men**
- 68% are aged **60-79 years**
- 72% are **married/living with partner** and 26% are divorced, separated or widowed
- 62% have **further education or higher education** qualification
- 68% **retired** and 30% working

Profile 4: No Children – 15%

- 53% are women
- 77% aged **50-69 years**
- This group has a higher proportion of **single people (38%)** than all groups. 40% are **married/living with partner** and 22% are divorced, separated or widowed
- 48% have further education or higher education qualifications
- **This group has a higher proportion who are either unemployed, sick or looking after family (17%).** 57% **retired** and 26% working

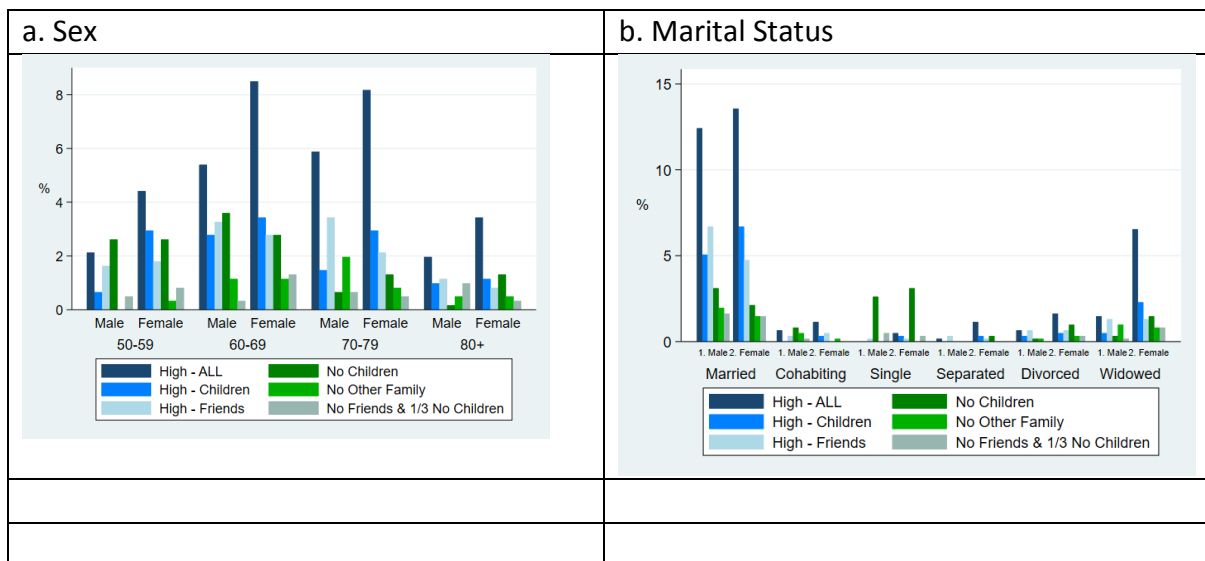
Profile 5: No Other Family – 6%

- 56% are **men**
- 68% are aged **60-79 years**
- 64% are **married/living with partner** and 36% are divorced, separated or widowed
- 36% have high school qualifications, 23% have further education qualifications and 31% have a higher education qualification
- 72% are **retired**

Profile 6: No Friends – 6%

- 55% are women
- **Broad range of ages**
- 61% are **married/living with partner**, 15% are **single (never married)** and 24% are divorced, separated or widowed
- 66% have either **no/school qualifications**
- 64% are **retired** and 24% are working. 12% are either **unemployed, sick or looking after family**

Figure 8. Sociodemographic Characteristics of the Social Connected Profiles



Rurality

Across all profiles the majority of people lived in urban locations, although this varied from approximately 58% of those in Profiles 3 and 4 (High – Friends and No Children) to 79% of those in Profile 6 (No Friends & 1/3 No Children).

How do older people value their social connections?

Older people were asked about the number of close relationships they had with their children, friends, and family. This is taken to represent the strength or value of their social connections. There was significant variation in the value placed on the social connections across profiles.

Overall, those with the most frequent social contact (Profiles 1-3) tended to have closer relationships. Few people have no close relationships, but those without any close relationships are most likely to belong to Profile 6 (those with no friends and one-third without children). See Appendix, Table 2 for further details.

Children

98% of those with connections to all social groups (Profiles 1, 2, and 3) have at least one close relationship with their children, and 79% of those in Profiles 1 and 2 are close to two or more children. Profile 4 have no children. 28% of Profile 5 have at least one close relationship with their children, and 62% are close to two or more. For Profile 6, and of those with children, around 52% have a close relationship with 2 or more children. See Figure 9.

Friends

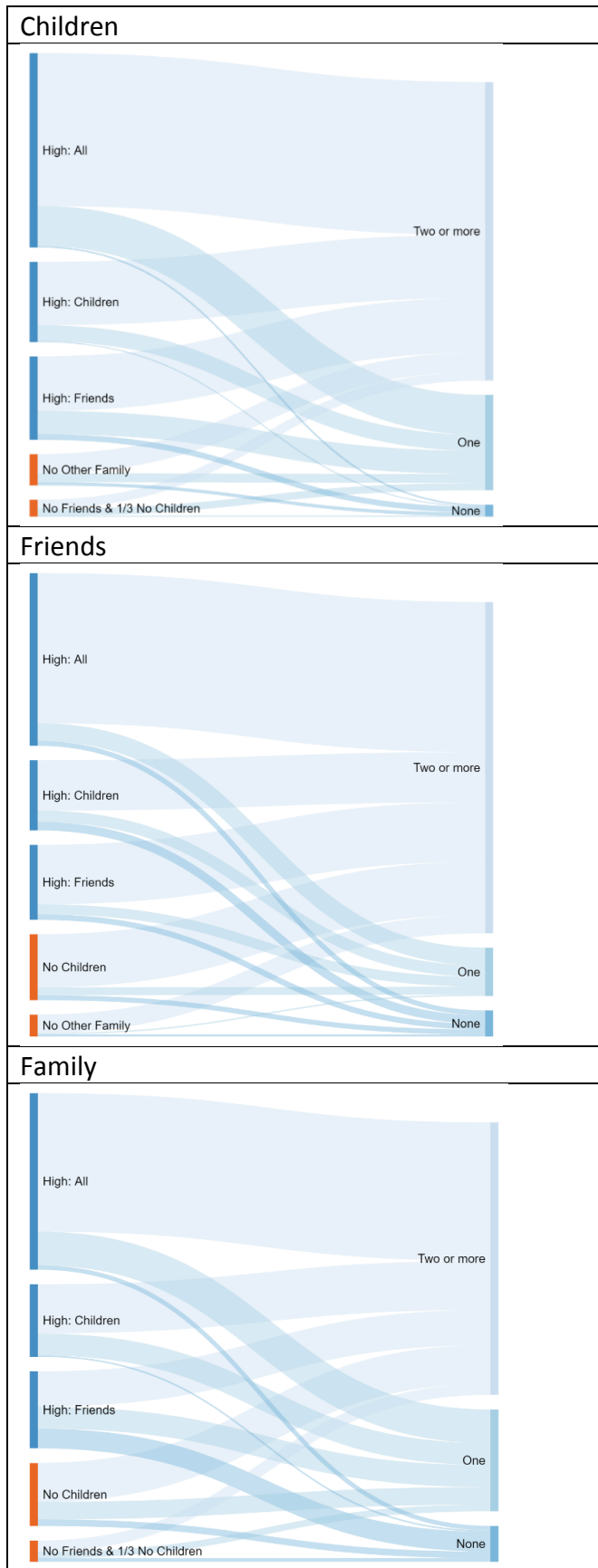
Most people have a close relationship with at least one friend. At least 80% of Profiles 1, 3, 4 and 5, have close relationships with two or more friends. Profile 2, for whom contact with children is arguably strongest, have relatively fewer close relationships than other profiles

yet 16% have a close relationship with at least one friend, and 72% with at least two friends. See Figure 9.

Family

There was wide variation across profiles in those who have close relationships with family. Profiles 1 and 2 have more close relationships with family than other profiles. In particular, 25% of those in with a relatively high social connection with friends (Profile 3) have no close relationships with family. Profile 5 have no family. Almost half (48%) of those in Profile 6 (those with no friends and one third no children) have 0 or 1 close relationships with family. See Figure 9.

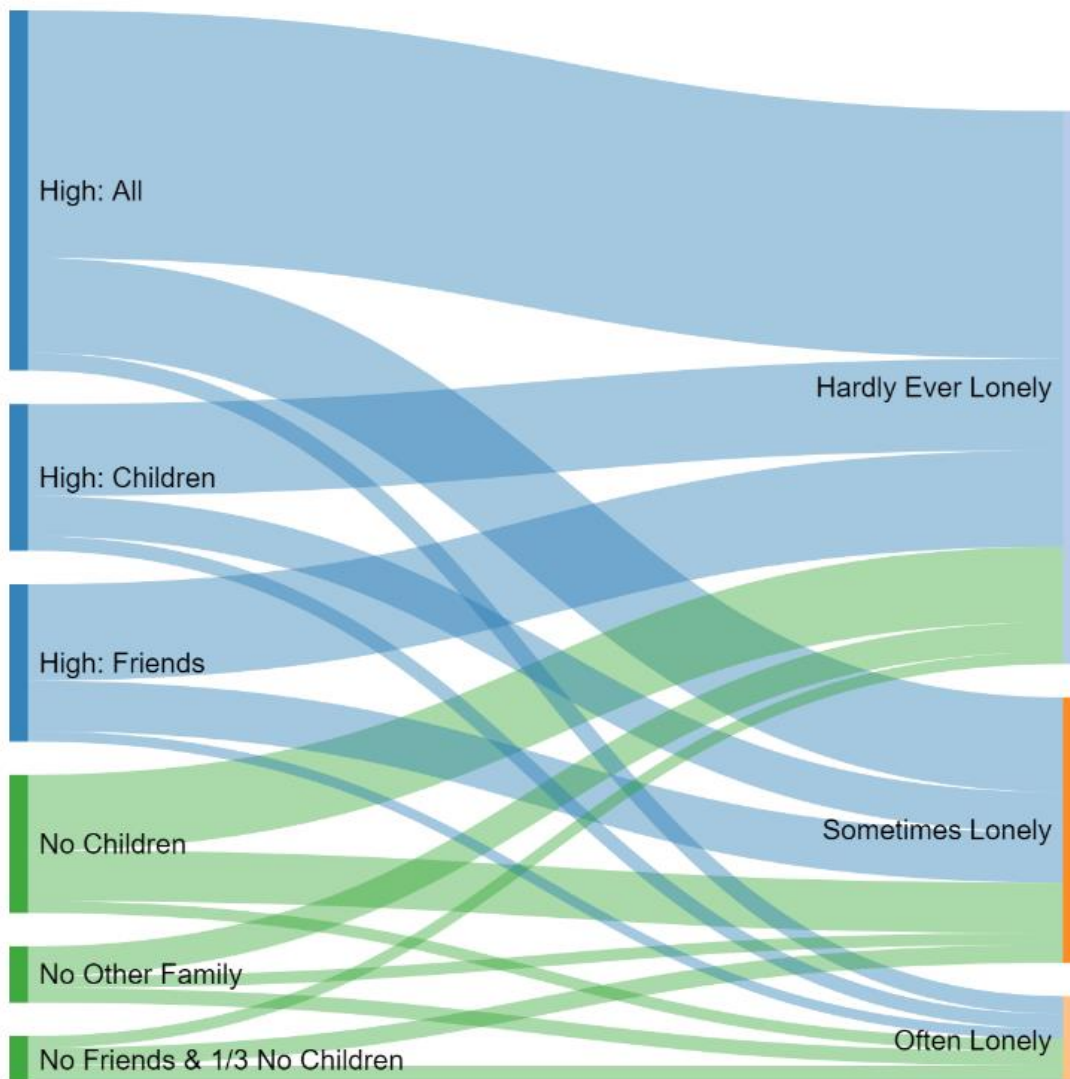
Figure 9. Association Between Quality and Quantity of Social Connections



What is the relationship between social connectedness and loneliness?

We know that social isolation and loneliness are distinct yet inter-related. This is evident within our sample (see Figure 10) where the profiles of social connection are shown in relation to the levels of self-reported loneliness. Those in Profile 1 have the greatest proportion of who are hardly ever lonely yet a small but distinct subgroup report that they often feel lonely. This pattern can be found across all profiles, including in those with fewest social connections.

Figure 10. Relationship between Social Connectedness and Loneliness

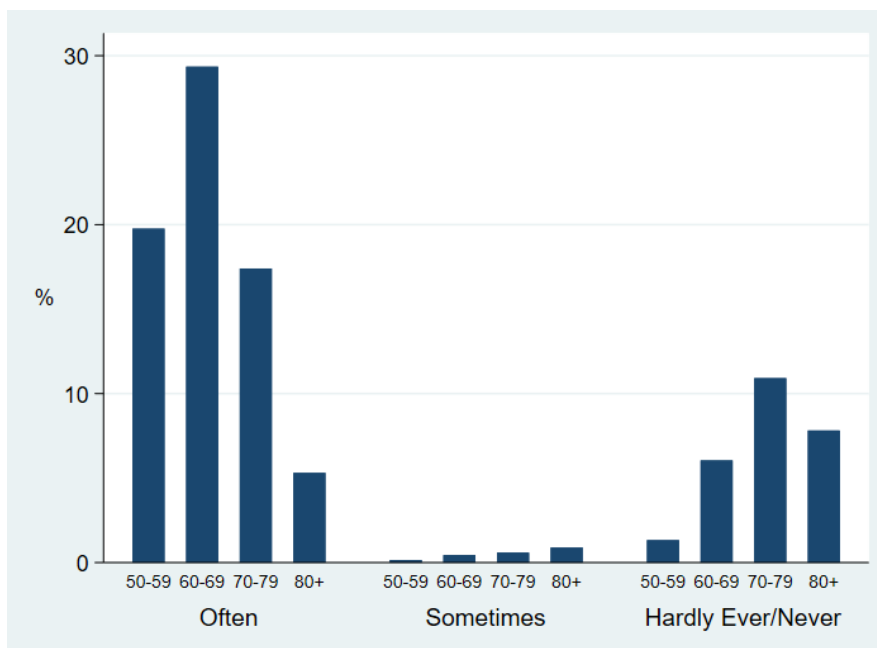


Use of Technology

How often do older people use the internet or email?

Around 70% or greater of all profiles used the internet regularly and there was no significant variation in the frequency of use across the six profiles (see Figure 11). However, internet use did vary by age, where people tended to either use the internet frequently or hardly ever. Those who used the internet or email often spanned across all age groups but were predominantly younger, and those who hardly ever use the internet are generally older.

Figure 11. Age and Use of Internet/Email



Where do older people use the internet?

Accessing the internet at home was the most frequent response (>80% across all profiles), followed by on the move, at work, or in someone else's home (see HAGIS Supplementary material, Table 3). Using the internet at a library/internet café was relatively infrequent, however we found significant variation in this practice across the profiles, for example, 27% of Profile 4 use library/internet cafes to access the internet while only 6% of Profile 2 do so.

Which devices do older people use to access the internet?

Desktop, laptop, tablets, and smartphones were the most commonly used devices to access the internet (see HAGIS Supplementary material, Table 3). There was a significant variation in the use of desktop computers where almost 50% of Profile 4 use a desktop.

What do older people use the internet for?

The majority (> 50%) of people used the internet for sending/receiving emails, finding information about goods/services and shopping (see HAGIS Supplementary material, Table 3). Searching for information, finances, social networking, and news were common in around a quarter to a third of the population. There was significant variation across profiles

for sending/receiving email and finding information for goods/services. Profiles 2 and 6 had the lowest proportion of people undertaking these activities, and Profile 3 the highest proportion.

Key messages

The quantity and quality of social connections vary in older people in Scotland. We found six distinct profiles of social connection in older people.

The majority of older people are in regular contact with their children, friends, and family by meeting up, telephone, or email/text. Some older people have little or no contact with either their children, family, or friends. However, in all profiles the majority of people have close relationships with at least two or more of their children, family, and/or friends.

Those people with regular social contacts are least likely to feel lonely. However, some people who are in regular contact with their children, family, and friends can often feel lonely. Likewise, some people who have little social contact are hardly ever lonely.

Men and women are well represented across all profiles. Interestingly, women aged 80 or above were most commonly found in the most connected profile (High – All). The greatest proportion of men (56%) are found in those groups with greatest connection with friends or in those with no family. Those who are married or living together were most commonly found in the most connected profiles. Those who are single were, perhaps unsurprisingly, were most commonly found in the profile of those without children. The least connected profile had the highest proportion of people living in rural locations.

Many older people use the internet or email to some extent and access it from their own homes. People who use the internet often are more likely to be younger than those who hardly ever or never use it. Older people use a variety of devices to access the internet including desktops, laptops, tablets, and smartphones.

The most common use of the internet in older people is to send or receive email, find information on goods or services, and shopping. These activities varied by social connection profile. However, those with the fewest social connections were also least likely to use the internet for email or to seek information which may have implications for how we could use technology to reach these people. That said, those with regular contact with their children (profile 2) were less likely to use the internet for these activities. It is not clear, however, if their children may use the internet on their behalf for information seeking or shopping. This may warrant further investigation.

Focus groups and Co-creation workshops

The findings from these two parts of the project are presented together as an iterative analytical process took place where findings from the focus groups were reviewed and refined through the co-creation workshops.

Data from the focus groups was analysed using a thematic approach and a series of themes and sub-themes created. As discussed, these themes were then ranked and the rankings checked at the co-creation workshops. The final set of ranked themes is presented below. These themes relate to the challenges and opportunities that technology brings when promoting social connectedness.

Challenges

A series of common challenges were identified associated with the technology itself, how technology is used and about the people involved, both those supporting the use of technology and those using it.

1. Security and risk
 - a. Financial abuse/scams
 - b. Feelings of/reality of surveillance
 - c. Protecting human rights – as an important aspect to consider when using technology
 - d. Trolling/abusive comments
 - e. Reducing human contact
 - f. Access to distressing content/fake news.

While many risks were identified there was also a reminder to not over-emphasise risks and a belief that with training technology could be used safely by most people. There was an indication that using NHS systems, such as Attend Anywhere, may be perceived as safer as a venue for discussion of sensitive topics. Access to distressing content was seen as low risk.

There was also a reminder to consider how perceptions of risk may differ between different groups, such as staff and service users.

2. Accessibility and equality

There was a wide range of factors that were felt to impact on whether people will access technology. There was little difference noted between the first four ranked below in the importance of these different factors.

- a. Need for training and support to use technology
- b. Cost of technology may be high for some/all (digital poverty)
- c. Quality and reach of internet signal is not equal
- d. Differing needs and wants of individuals
- e. Lack of participatory design
- f. Pace of change is fast so difficult for organisations and individuals to keep up
- g. Impact of age – cohort effects
- h. Different in availability of technology across regions.

3. Individual engagement with technology

The barriers noted above include some individual factors and there were felt to be important in whether individuals decide to engage or not. The main motivating factor identified in the co-creation groups was whether the technology was useful or not for the individual.

- a. Understanding the potential and usefulness of technology
- b. Finding value in technology for individuals
- c. Using technology in new ways
- d. Usability
- e. Size and weight of devices
- f. Knowing what is available

4. Staff buy-in and support

For services that aim to use technology to promote social connectedness the role of staff will be key in determining success. There were a number of barriers noted to staff engagement and involvement with these projects.

- a. Supporting technology use may be outwith usual/historical job role
- b. Ensure staff involvement from the start
- c. Access to specialist IT staff is helpful.

Opportunities

1. Technology making life easier

In the focus group discussions it became clear that impact of technology on social connectedness was not always direct. Technology could be used in ways that made life easier for individuals thus freeing up time and energy for social activities. The main ways that technology made life easier are ranked here. Members of the co-creation workshops also noted that technology might be used pass the time.

- a. Reduced stress associated with travel/waiting/attending appointments
- b. Supporting independence
- c. Reduced travel time for health appointments through use of VC and text
- d. More time available
- e. Technology supporting connections within wider social system
- f. Technology being used to pass the time

2. Keeping in touch

Technology was very important for people to keep in touch with friends and family and the use of different video calling systems were popular alongside social media websites such as Facebook. However, these technologies pose particular challenges for people with sight loss.

- a. Video call means you can SEE how people are doing
- b. Intergenerational and international connection with family e.g. Skype and Facebook

- c. Messaging apps (e.g. WhatsApp) enable informal group chat

3. Training and education

Information, instructions and training were all rated as very important in supporting the use of technology for social connectedness. Users were looking for simple written instructions or those using video or practical demonstrations. **Peer learning** was felt to be better than asking younger people for help as they may not have the relevant skills and understanding to provide useful guidance.

- a. Basic written instructions so can learn independently and remind next time you use
- b. Practical demonstrations work well
- c. Video/animated guidance
- d. Staff and volunteer training
- e. Peer support and training
- f. Access to information about what is available
- g. Simple tech is best (e.g. iPhones/iPads)
- h. Intergenerational support e.g. grandchildren as teachers.

4. Finding your tribe

- a. Connecting online with people locally with similar interests
- b. Finding people locally with similar interests (e.g. women's walking group)
- c. Access to people around the world with similar interests
- d. Providing community groups with online presence
- e. Online exercise classes e.g. Tai Chi.

It was interesting when these were ranked to see that it was felt that connecting with people and finding opportunities locally was more important than accessing the wider world.

Key messages and recommendations

We found positive examples of technology supporting social connectedness both **directly**, for example, using Skype to connect with family overseas and **indirectly**, by technology freeing up time and energy for social activities, for example, accessing NHS support through text messaging or videoconference.

The following recommendations emerged for organisations and individuals thinking about using technology to support social connectedness:

PEOPLE: recognise potential users as individuals, avoiding assumptions about age, gender, disability etc, and protecting human rights.

RISK: careful consideration of risks for individuals is needed but balanced presentation of risks is important.

PARTICIPATION: get staff and potential users on board from the start involving them from the planning stages onwards.

SYSTEMS: carefully assess infrastructure as well as devices for cost, accessibility, suitability and usability.

TRAINING: users will need support and training to use new devices, peer-to-peer learning, hands-on demonstrations, and simple take-home instructions are recommended.

Conclusions and next steps

The T&SCon project has taken a robust and engaged approach to developing a better understanding of the potential of technology to support social connectedness for adults in Scotland as well as providing a deeper understanding social connectedness and its relation to loneliness. The project has provided a detailed report of the evidence base alongside easily accessible guidance for individuals and organisations wishing to use technology to support social connectedness. The report also provides links to the full evidence base utilised within the study for readers looking for the underlying research evidence and practice examples.

The project has demonstrated real potential for technology to have a positive impact on social connectedness but also cautions that care is taken to assess individual preferences and needs and to consider risks to individuals and organisations.

The T&SCon guidance and the project resources including supplementary material from the HAGIS analysis, the technology scoping database, the literature review data base and supplementary materials, can be accessed at: www.tec.scot

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