Implementing technology to help people live really good lives:

What people want from technology enabled care

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Contents

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Introduction and context

The TEC Action Alliance commissioned research to examine what people want from technology and to create clear and consistent language to describe how it can support them to live 'gloriously ordinary lives'. This report sets out the research findings and presents a codification table (with accompanying non-functional themes) to support navigation around what people want their care and support to look like, and the role technology can play to help achieve this. This research builds on recommendations developed through a challenge paper and is intended as research that will contribute to a follow-on 'action paper'.

Overview of research design

The findings discussed in this paper are drawn from the following:

- A rapid review, international in scope, which considered frameworks and evidence around what people (from a range of backgrounds and circumstances) who draw on care and support want, considering how different types of technology are used in everyday life. It considered both specialist and mainstream software, devices, tools and gadgets – to reflect the myriad of ways through which people utilise it. This review draws on just over 100 literature sources, and 26 case studies. Our starting point was a TEC categorisation developed through a policy and practice perspective, which was published through the Economic and Social Research Council-funded Centre for Care (81).
- Interviews with 15 stakeholders with knowledge in the field, including a mix of staff based at local authorities, the third sector, within academia and technology developers
- Fieldwork with 42 people who draw on care and support and their families, including 10 one to one interviews and 6 focus groups This entailed sense checking the codification themes, exploring how people use technology, and views around different types of TEC. A selection of discussion points and illustrative quotes are provided in a narrative section of this report. We purposively selected groups whose voices are less heard across the main literature. Participants were drawn across a range of ages, cultural and socio-economic groups, health and social care needs
- The research that underpins this report has been guided by a working group, which included Deborah Rozansky (Director of Policy, Research and Information, SCIE), Karen McCormick (Founder of inCharge Ltd), and Steve Sadler (TSA Associate - Technology Strategy).

Developing the codification table

Initial codification themes were developed through the review, giving regard to existing evidence (see Appendix 2), which were then 'tested' and refined through the fieldwork. The final table reflects the language that people themselves use when considering their day to day needs and desires, and how technology may enhance this. The functions are broken down into discrete categories for the purposes of highlighting existing evidence, with many people adopting technology across several of these. The language adopted through the TLAP Making it Real framework (80) provided a good fit to the non-functional themes people valued. The functions also align well to a TEC categorisation published through the Centre for Care, which focuses on policy and practice (81) (see Box 1).

The specific ways in which TEC can support people to live well differs based on factors such as age, health conditions and housing tenure. Therefore, the codification table is designed to be indicative – and doesn't substitute for the need to involve people in the process of developing TEC. The evidence and primary fieldwork highlight that the ways in which technology enabled support is created and offered can be as important as the technology itself. People frequently report that they want to be more involved in shaping the technology that they use.

A few interviewees had been involved with co-design and described the importance of feeling genuinely listened to, buy-in from staff (e.g. if in assisted living), and being able to meaningfully influence outcomes and offer challenge. A discussion of coproduction is considered in the TECAA challenge paper.

Reflections on the evidence base

Whilst we feel confident that non-functional and codification themes reflect the priorities and language that many people use themselves, there are a number of limitations within the evidence base around what people want within these:

- The voices of those who draw on care and support and their family are far less numerous than those from the perspective of staff, organisations and systems.

- Prior research is mostly based on small sample sizes (in many cases convenience samples) across a range of different contexts, with limited quantitative approaches. Where more quantitative approaches have been taken, there is a tendency to measure outcomes (e.g., reduced falls), rather than what people say they want.

- Findings across studies sometimes contradict each other - this is not surprising due to the small samples and where needs may differ based on circumstances and demographic characteristics. In particular there is limited information which sheds light on how engagement with digital health technologies differs across groups (such as young people, different ethnic groups and those from low socio-economic status).

- It is not possible to report robustly on the kinds of technology preferred, as the vast majority of literature sought feedback on particular types of technology – rather than comparing different ways to meet care and support needs. Identifying the types of technology that people are most likely to use is not a useful proxy for what is preferred. In many cases people are not aware of the full range of TEC options, and what is used was provided without the person being offered a choice (such as being provided with a pendant through their local authority, and being unaware that other appropriate options may exist, for example).

- Much of the evidence focuses on similar types of types of technology, such as use of video for consultation and socialising, and use of fall detector pendant alarms (which tend to focus on older people), whereas newer AI-based or sensor technology is particularly sparse and more based on individual case studies. With young people the focus tends to be around digital safety and impact of use on health and wellbeing (with the exception of self-management, particularly mental health related apps).

- We did not identify evidence around what people want across all categories of technology, and it may be that as examples are identified these can be added to the table. The TECAA, working with the University of Sheffield is in the process of developing a robust evaluation framework which can assist with exploring, and potentially filling some of these gaps.

- As similar themes came up across several different evidence sources, and based on published resources which explore what people want across all areas of care and support (including non tech solutions), we can more confidently report on the values that should be followed through design and implementation, these 'non-functional' themes can be found in Box 1.

- The evidence suggests that there is a desire to more toward a more proactive, preventative approach, and that people like to do things to maintain their overall health and wellbeing and avoid crisis where possible. Whilst we are unable to point to much robust evidence which compares reactive versus proactive technology, we can conclude that where possible this should be put in place, bearing in mind that some people may not acknowledge that they require any form of support until a crisis occurs.

Codification Table for types of technology-enablement of care & support

The table has 6 overarching functions and 14 sub functions – all framed around how to support a person to live a "gloriously ordinary life". The main table provides a brief overview of what the evidence is telling us. *Appendix 1* provides a more detailed breakdown of the evidence assessed across the different types of technology, which is numbered to aid navigation to the original evidence sources *(Appendix 2).* Technology-enablement of a person's life often requires supportive services that wrap-around the technology, to respond to information and alerts, help to understand how to use, and so on. These services are assumed to be part of the 'tech' categories described in the table.

Function categories	How can TEC support these needs and desires (based on assessed evidence)
Staying well by being connected to others	
1. Helping me to stay connected and socialise with family, friends and the community	**Tech covered**: communication/messaging (email, text, Skype), falls detectors, intercom, mental health and wellbeing apps, smartphone, social media (Facebook, WhatsApp), social robot, tablet/iPad, telephone, video software, voice activated control (Alexa), Wi-Fi. There is a relatively large body of research focused on digital connections, particularly for older people. Positive examples of off the shelf technology and software helping people to maintain a sense of belonging across family networks and their wider communities, with specialist TEC and apps which has in-built functions to enable communication valued. Older people in particular report anxiety around replacement of human elements of care and support, and lack of confidence and skills to benefit fully from technology.
2. Helping me to effectively communicate	**Tech covered:** Computer, Communication device, digital health records, Smartphone, speech generating device. People value using digital tools and specialist devices which give them the ability to ensure their voice is heard and easily record personal preferences. User friendliness particularly important, good to involve loved ones for support. Lack of compatibility of specialist software across different types of technology can be a barrier.
Living well in and around the home	
3. Supporting me to manage my home environment	**Tech covered:** beacons, door entry system, smartphone, smart door locks/openers, smart lightbulbs/blinds/heating/plugs/sensor lights, social media, vibration pads, video doorbell, voice activated control (Alexa), Wi-Fi. It gives people an element of control and means they can carry out some tasks with less reliance on carers or family members (and in turn offers peace of mind so family worry less). People value technology that is unobtrusive and slots in easily with what is already used. Those with dexterity or mobility issues flexibility built in (e.g., voice commands).
4. Supporting me to carry out everyday tasks	**Tech covered**: automated tools (handwash/medicine dispenser/jar opener), digital apps, monitored medication dispenser, orientation system, robotic vacuum cleaners, smartphone, smartphone built in features (Apple pay), smartwatch, tablet, voice activated control (Alexa), Wi-Fi. Preferences vary based on individual circumstances and need, people use tech overall to minimise the challenges they face, give peace of mind and allow them to accomplish tasks that would be more difficult or would require someone to otherwise help. People like tech that allows them to carry out a range of different tasks – and are compatible with other tech used.
5. Providing (assistive) support when I need it outside the home	**Tech covered**: smartphone/other digital devices (theme not covered in detail for this research)

6. Supporting me to keep mentally and physically well and do things I enjoy	**Tech covered:** kindle, smartphone, smartphone apps, tablet/iPad, video software, voice activated control, Wi-Fi People tend to use off the shelf technology and apps to support hobbies, learning and interests – devices used to accomplish a range of tasks, whereas specialist apps are identified to support particular desires. Technology enabled family to do more things they enjoy, as it provides peace of mind. Some barriers around access and confidence.
Living safely in and around the home	
7. Helping me to move around safely at home	**Tech covered:** Aids and adaptations: Non-tech/tech shower chairs and stools, bath lifts, raised toilet seats & frames, grab rails, and mobility aids, welfare checks, regular check-in calls: Providing ability to age in place top reason given for using these, access to ongoing maintenance important, as is avoiding bulky or medicalised items which are perceived as stigmatising. Cost a barrier. To note – a full review of what people want from Aids and Adaptations was not carried out as it went beyond the scope of this work.
8. Providing (urgent) support when I need it outside the home	See number 9.
9. Providing access to help when I need it urgently	**Tech covered:** CCTV/Webcam, fall detectors, GPS/tracking devices, helpline button, pendants, sensors (worn on body), sensors (property exit, heat, bed), remote response teams, smartphones, smartwatch, tablets/laptops, voice activated control Used to offer "back-up" where needed and enable ability to live independently valued, as is providing loved ones with peace of mind and the ability to support their wellbeing. A wraparound service (reliable when reactive, caring and proactive where needed) is an important factor. Some usability issues, reports of misusing technology that requires actions, also barriers around perceived stigma and breach of privacy. People tend to prefer tech that is unobtrusive and fits in with what they use already.
Access to quality information, advice and support	
10. Supporting access to information and advice when I or my family need it	A lack of awareness or recognition of more specialist TEC a common theme. People would like a more 'personal touch' such as access to an independent advisor to help them decide. Good practice examples include the use of accessible demonstrator sites, digital hubs, online resources with easy navigation and plain English descriptions, easy to follow guides and libraries, local access to training and support, and for young people particularly – information shared via social media. People also valued accessing information through their peers and access to ongoing support once technology is purchased.
Monitoring and managing own care, health and wellbeing needs	
11. Helping me to monitor and keep track of my health and nutrition needs	**Tech covered**: gadgets (hydration cups, tip kettles), home monitoring devices, self-management/telecare smart apps, smart applications, Spotify, wearables. People value technology which empowers them to learn about, keep track and actively manage health and care needs when it is

	more convenient, and supports them and loved one to pick up potential issues earlier. Important that it is easy to use, does not cause additional burden and there is access to advice and support where needed. Preferences can depend on ages, and ability to customise and personalise.
12. Supporting me to interact with health and care providers	**Tech covered**: smartphone, telephone, video software, voice activated control, bespoke hardware, wraparound service, People like where it can speed up process of accessing help and support sooner, also flexibility elements. Good option for those who struggle to access face to face. Some struggle to use digital if have high level needs, also require reassurance that there is access to alternatives if things go wrong.
13. Supporting me to manage my own care and support needs	See 11.
Proactive support to maintain care, health and wellbeing	
14. Early intervention is available when I experience changes to my physical needs and behaviour	**Tech covered:** mattress sensor, mobile phone (inc smartphone), plug in sensor, passive monitoring sensors, monitoring centre/platform. Peace of mind came up as a recurring theme, also value of receiving early triggers and ability to avoid crisis and unplanned use of health services. Improved family relationships as less need to "check-up" on care needs, like where able to access data and monitor changes, where there is flexibility to shape this to meet needs, and that a professional is monitoring. Like that specific action is not required. Some concerns around reliable connectivity, and perceived invasion of privacy (ability to try things out, and provision of information helped to mitigate to some extent).

Codification table thematic discussion points

This section considers the non-functional themes (Box 1) that came up frequently across the research, focusing on the key issues and debates

Box 1: Non-functional themes

1. People want to know more about the ways in which technology can meet their needs
2. *People want to do more for themselves*
3. *People want to maintain control where possible*
4. *People want peace of mind*
5. *People want it to be seamless and compatible with technology they already use*
6. *People want it to be personalised and offer genuine choice*
7. *Design, functionality and wraparound services are important, and people want a say in how these are developed*
8. *Some people struggle to access or adopt technological solutions*
9. *People want to be reassured around privacy and have autonomy around how data is managed*

1. People want to know more about the ways in which technology can meet their needs

Not knowing where to access information around how technology can support care needs emerged as a key issue throughout the fieldwork. The literature provides examples of positively mitigating this through providing access to specialist support and letting people try things out (see Table category 10), though few interviewees had benefitted from these. Interviewees tended to find out about technology through more informal avenues, such as Google or recommendations from friends or professionals (though one referred to a helpful magazine accessed in a social service waiting room, another reported positively about finding out about different types of TEC through being invited to talks through involvement in a pilot).

This meant that people were not generally aware of the full suite of potential options available, with most having not heard of terms used to describe more specialist TEC. Others talked about the vast array of apps that were out there, but not knowing how to identify what could be right for them, such as to track their mood, support mental wellbeing, or monitor sleep.

This lack of awareness perhaps contributes to the perception that specialist TEC is "at odds" with how people live their day to day lives. The evidence (1, 19, 31) and fieldwork consistently showed that people respond less well to technical terms and prefer technology to be framed in plain English and focused on solutions:

> *"It is all very well having slogans and straplines; they are just words – that's great but I want to know the outcomes. What are the tangible benefits for me… what difference will it make to my community, what does it mean to me*." (Person with care and support needs)
>
> *"It would be helpful if there was more public awareness of technology that supports care, so it is not such a hard sell to parents … demystifying it so it feels less like Big Brother is watching you."* (Family Carer)

Another interviewee talked about how he would value some support to find out about any technology which could support him to meet some of his needs:

> *"I could do with a technology expert, or a mobility expert to…talk me through what is best…someone who sits down and listens to what you need – then considers what technology is available to meet the need – and lets you try it out."* (Person drawing on care and support)

Following the evidence, having the opportunity to share experiences with peers, seemed effective. Interviewees recalled examples of peers who initially did not wish to use technologies, but changed their minds once they saw how it was benefitting others first hand. Others gave examples of Apple Pay and video doorbells as innovations which people, though initially unsure, embraced once they used them and identified how they could improve aspects of their lives. Those who were using motion sensors felt that their initial trepidation had been unwarranted once they got to try it out.

2. *People want to do more for themselves*

Supporting people to do more things for themselves and remain at home emerged as a chief motivator to adopting technology across all age groups and conditions (46, 76). This was also the case for family carers who reported greater freedoms around going to work, socialising outside and building more meaningful relationships that centre less around care and support needs.

Interviewees acknowledged that whilst some specialist TEC is not perfect, if it offered the best way to retain independence, acceptance was higher:

"[motion sensors] it's a bit big brother but it reduces invasion compared to an antenna shouting in your room – just calling to see if you died in the night. So it sees movement instead."

Another interviewee explained that though she did not like her pendant, it was preferable to relying on a cord – as it meant they did not need to "drag" themselves to the cord following a fall, and she could continue to live at home safely (this person had no awareness of motion sensors).

On the flip side, people talked about the risk that inappropriate technology use can reduce independence, feeling strongly that it should not be "offered for the sake of it":

"Someone told me about a way to automatically open my curtains – I do struggle [with mobility] but actually I can get up and do this myself. I don't want everything done for me as I need to exert myself where I can so I don't lose even more of my mobility."

In contrast, a participant with similar mobility needs described an automatic curtain opener as improving her quality of life, as she could now close her curtains rather than leaving them open at night, or relying on a carer to shut them for her. This is where a guided discussion was felt to be necessary, to understand what a person's needs and preferences are prior to recommending technology enabled solutions. It also supports the literature which recommends that technologies be implemented as part of a package of support, rather than viewed as the only solution (63).

3. *People want to maintain control where possible*

The research highlighted high levels of satisfaction where people are able to self-manage and control elements of their care. Conversely, people were negative about TEC where they felt it would lead to loss of control (14, 34) (see table functions 11, 12). Fieldwork participants reported positively about keeping track, recording and interpreting information, be this through reviewing data provided through motion sensors, self-management apps, or choosing who is alerted in an emergency. As with the literature, people were more positive if they felt confident that a professional was on hand to provide support when needed (at least for more specialist, or health led tech).

Apps were frequently mentioned positively, and used to track diet, measure heart rate, access games and mood tracker tools to support mental health and sites such as YouTube to find recipes

and exercise classes to maintain wellbeing. Younger participants valued having access to technology that they could use without help, and which their friends used. This tended to be "off the shelf" technology, particularly smartphones and apps linked to these:

"I use my smartphone and a smartwatch that is linked to this – I can use this for what I need, to speak to my friends and family, take with me when I go to work as I have a part time job. I get anxious sometimes and I can get upset if things don't go to plan – this is easy to use and I can keep track of my activities [using an app], I also use it to play around with when I get stressed as this can calm me down…I will watch something [on smartphone] when I am anxious too. My phone battery is nearly out but it lasts longer on my [smart]watch so I can use that."

Family members talked positively of functionality that allowed them to control things at a distance, particularly where connected to technology that they used already:

"We got mum a [WiFi] camera – it is great as I can control it from my phone – I can get a better view and move it sideways; I can speak through it…I get messages on my phone… we get notifications – it is like a security camera and gives us peace of mind*."* (Family Carer)

Participants were also positive about more "preventative" technology which allowed oversight, such as data dashboards from motion sensors. Whilst in some cases the person with care needs had no interest in accessing this data, they did wish to exert control over the types of information that was collected, should reflect their needs and wishes:

"It feels a bit overkill as the sensors are everywhere…they sensored my house up to the hilts – they know when I am coming or going…when I am eating and drinking – it's on hot water pipes, the airing cupboard, my underwear drawer – it's on doors so they know if I am in or out. I think this goes too far for me, it should be set at various levels … if it gets too invasive – you should be able to say, "lets downgrade" I think you need a balance, maybe less if your needs are less."

Family members respected that loved ones should have the ability to control technology adopted and provided examples of tailoring solutions, such as not having heating control on a motion sensor. A family member using motion sensor technology discussed her view on using cameras:

"[Mum] isn't at the stage where she needs smothering by me, it wouldn't feel morally right – but a camera doorbell could be useful – not directly looking at mum…perhaps a doorbell with camera could be good in a couple of years as there have been scammers in her area…I wouldn't use a camera in the house unless she was bedridden – and carers were frequently visiting, just for that extra peace of mind." (Family Carer, person cared for has motion sensors)

What sometimes emerged was the need for a compromise to be reached, such as where an interviewee at risk of falling agreed to motion sensors but refused to wear a pendant:

"Mum made noises [about using motion sensors] but it is low impact, she didn't have to do anything. I am not nagging and saying have you put on your pendant, have you charged your watch, I am not nagging and it is quietly going in the background." (Family Carer)

4. People want peace of mind

Wider support networks are key influencers in uptake of technology, with the literature highlighting how they offer practical and emotional assistance (12, 32, 34, 55, 61). Family members interviewed provided examples of showing loved ones how to use smart technology, setting up WiFi cameras to observe areas in the home, and encouraging them to try out motion sensors or a pendant.

Some people with care needs reported that providing reassurance to family members was the main reason they had accepted technology solutions, with many feeling that they did not need it. Reported triggers tended to be following a fall, or if a person lived alone.

The extent to which technology could provide peace of mind very much depended on individual circumstances, and there is not a particular type of technology that can be recommended to meet need. For example, whilst some viewed CCTV as an invasion of privacy, others reported that it gave them reassurance (ease of access and price were additional enablers in this example):

"I have put CCTV up in the porch – if anyone comes to the door, I get a warning on my phone. There have been a lot of thefts in the area and I have found it to be a great support. I only have to look at my phone, to tap the screen to see who is at the door. It helps me feel safe, I just look at it on my phone and the CCTV works off of WiFi –it was only £50."

As with the literature (see Appendix 1 theme 8), there were widespread reports of pendants not offering peace of mind as they tend to be misused (such as not being worn or activated). Some interviewees said they had stopped using them:

"*When we realised she wasn't going to use the pendant we put a plan in place where neighbours– if they notice she has not gone out – ring me…I also had a word with the day centre [she goes to] – and knew they would be checking on her…I felt reassured the neighbours were watching …sometimes it is relying on people around you when the tools don't work." (Family Carer)*

Sensors appealed to those who cared for family members with cognitive impairment in particular, as their loved one were not required to act. Others felt it was less obtrusive than using CCTV:

"[passive tech] it's a little dot – I know someone who uses it who says it doesn't invade privacy and she says she forgets about it. You don't have to think about whether an alarm is working or you [have got your] pendant on, so it helps you have independence in the house."

Though most non-users were sceptical that sensors would work as they should, most viewed that as pendants or cords did not offer reassurance in any case, they were probably worth a try. However, there was an example provided where sensor technology (pads) did not work as intended, as the main unit had a light that her mother turned off at night and forgot to turn it back on. As a result they purchased a WiFi camera online as it was smaller and could be hidden.

Some interviewees described “mix and match” approaches to ensuring peace of mind, such as trying out motion sensors in addition to a CCTV camera, as she found the latter to be “arduous” as a full time worker and mum. Another is using a Wi-Fi camera, pendant and motion sensors, feeling that each offered an additional layer of reassurance:

“She has got a WiFi camera which sits in the living room, it gives a good peripheral view but we can’t see the bathroom, front door or bedroom, we are going to trial sensor pads in the bedroom as sometimes she may get up in the night and wanders around the bedroom, it will be good to have that extra layer… she will have more privacy as it is just a sensor on the door… I like the camera as well as it gives peace of mind if there are visitors. If I get a message from the WiFi camera I can look and see it is the supermarket man at the door…the sensors won’t pick that up... She has a pendant which is good, but she is prone to losing things, she won’t wear it in the shower and she won’t wear it to bed – so we worry that she may be wandering at night without it... but we would rather stick with it as it is another thing to offer peace of mind.” (Family carer)

When asked about getting outside, interviewees described using a mobile phone and setting reminders or features so family are contacted if things go wrong. However, a few reported that they sometimes forget to take it, with one concerned that her support worker would not be able to get hold of her (when wearables were suggested by another focus group participant, she said she would consider it, though would need support to do so as it was not something she was familiar with).

There was general agreement that technology alone is not sufficient to offer peace of mind, and that it was necessary to keep in regular touch with family to talk through what is happening in their lives. For those who use motion sensors this was to give context if behaviour patterns change (such as staying up later than usual to watch international football or having a relative visiting). Interviewees also described how they valued services that wrap around specialist tech that they used, including having access to a reactive, reliable service, and/or more proactive calls to check ongoing wellbeing.

5. People want it to be seamless and compatible with technology they already use

Many literature sources iterate that technology needs to fit into people’s daily routines (6, 14, 55), moving away from discrete products or services to a model which allows for “bundling” together to achieve a more holistic solution (31). There is higher assessed demand for technology which is already familiar and can integrate across other elements of care accessed, rather than feeling like ‘another thing to remember’ (39, 42, 51). A need for solutions to fit into existing daily routines was evident in the way people blended technology and non-technology solutions together:

”I use phone reminders for my daily medication, but once a week I have an injection – so I use post-it’s to triggers my memory – I have it in my calendar but I am running around so much that I might forget otherwise…I remind myself of things on the phone – I send myself a text message to say remember to do this – I sometimes get my friend to text me something so that I remember – this works for me.” (Person with care and support needs)

Interviewees talked positively of technology that supports a range of everyday needs (care and non-care based) in one place. For example, one liked that a tablet provided with motion sensors allowed him to communicate with family, prompted him to open windows during a hot day and sent a humidity alert to avoid mould in the bathroom.

More people are choosing off the shelf products to meet care and support needs, such as voice assistants, smart speakers, "wearables" (e.g., smart-watches, activity trackers), as well as social media and apps to set reminders, manage health, fitness, wellbeing, gaming and financial needs, and to communicate with family and health professionals. Compatibility across other devices and flexibility to carry out a range of tasks is a big draw for smart technology:

> *"I have got an Alexa in every room, I love it. I use it for music and* radio and talking to my granddaughter, timing stuff in the oven, finding *out what the weather is doing …medication reminders – loads of stuff. [my granddaughter] uses Alexa as well, sometimes when we talk they talk to each other…I use it for blinds – there is an Alexa kettle – you can ask it to boil water."*

The extent to which technological solutions can fit into everyday life seamlessly was also related to whether something took on the appearance of familiar objects. Specialist TEC was viewed positively by interviewees when it either blended in with, or had a similar appearance to other everyday items, such as motion sensor that look like a "normal smoke detector" or wearables looking like "a watch I would normally wear" or "using the same phone that my friends use". People felt that it was important to ensure technology did not look "out of place". For example, intercoms and cords were viewed more negatively than small sensors. There are examples of specialist technology being swapped where the appearance was incongruent to how people wanted to present themselves. A young person with a learning disability stopped using a specialist communication device as he struggled to input information without a family member to support it, it was also considered cumbersome to carry it around and remember alongside his mobile phone:

> *"My son has used communication aids – but tends to use his phone now …the problem as a parent, is I still had to programme it - they put basic info on it and the rest up to you. He got used to it and used it to order fish and chips, but moved things around too much and I couldn't find them – another thing was to remember to take it everywhere he goes."*(Family Carer)

Linked to this, people preferred technology to be as unobtrusive as possible, such as being small enough to be hidden out of the way. One of the main assessed positive aspects of motion sensors is that people can get on with their lives and forget that they are there:

> *"I was persuaded [by daughter] to trial 5G sensors; I like that you can just get on with things without thinking about it and people can know what my needs are…I have a button to press in case of emergency but I am not always near it when I fall."*

As well as integrating with everyday technology, some felt it should be available to purchase via the same channels where they might purchase everyday technology products, without the

requirement for an assessment. For example, an interviewee chose a particular motion sensor service as it could be purchased without the need for an assessment:

"I looked at companies doing sensors, I picked [sensor provider] as I liked that you don't need to negotiate contracts, I didn't have to do anything, just go online and buy it…we are a consumerist society, if we want something we don't want to wait – we are used to having (it online)." (Family Carer)

Others explained that though items such as WiFi camera solutions were not perfect, they could be purchased online, which was convenient as they already shopped in that way.

6. People want it to be personalised and offer genuine choice

Closely related to the requirement for a seamless offer is the need to flex technology so that it meets different needs – as there is no one size fits all solution. Interviewees wanted to know about all the different kinds of technology available and to be able to choose which is best for them. Within this – people want to have a say in functionality, such as providing choice of who is contacted in an emergency, how much data is collected or shared, or the appearance:

"I don't use pendants; they do have their issues but they can work for some people. You need to show it to people though, show people the benefits and let them choose, they may want a chain, might want a bracelet – they might think it isn't really for them. Don't just give it to people – ask if they want it" (Person with care and support needs)

Interviewees held similar views when discussing online meetings with health and care professionals (see table number 13):

"I think [health and social care professionals] are trying to do too much online now, but I know someone who doesn't get out a lot – so being able to meet professionals and other people through zoom has been great for him – this is a good use of technology as long as you can use it as much or as little as you like."

Family carers who used motion sensors talked about the importance of it being adaptable to changing needs and circumstances:

"Being able to read signs for when someone is deteriorating is good – I haven't picked up anything with mum as yet – gets up twice a night, has as long as known her – not surprise to me when the data comes through. I see her a lot and we eat together regularly – so I know how much she eats at mealtimes. So it is not a problem now, but if she loses weight I will be more interested in movement in the kitchen." (Family Carer)

A family member who was knowledgeable about sensor technology was able to consider preferences across different kinds of sensor functionality – and was looking to change provider where the sensors are better able to measure changing patterns of behaviours.

As covered elsewhere, some people felt that “off the shelf” technology was able to meet some of their care and support needs. Where people with personal budgets had identified their own technological solutions, many felt disappointed that this was not considered an appropriate use of funds, with a few feeling pressured to accept tech that felt less appropriate to them (such as a pendant). This narrow definition of what technology is appropriate to meet care and support needs was also highlighted in the literature (39, CS24).

7. Design, functionality and wraparound services are important, and people want a say in how these are developed

As can be seen across the codification table in Appendix 2, and alluded to across this report, design and functionality issues can have a negative impact on uptake (11, 12). People have a diverse range of requirements and live in complex and differing environments, which are in turn impacted by demographic factors (age, socio-economic and cultural background) and access to family support (6, 12, 48) which will all impact on the TEC solutions preferred. Ensuring that products and services are co-designed can mitigate against some of these issues.

8. Some people struggle to access or adopt technological solutions

The literature highlights that some people are less likely to access technology or have a say in how TEC can achieve solutions for them (such as those who live in poor housing conditions or with limited income (47)). A lack of skills and confidence, connectivity issues, cost, household environment (e.g., lack of privacy), and limitations due to existing disabilities and health conditions are frequently reported barriers (12, 14, 19, 21, 44, 49, 51, 54, 59, 61, 63, 74). Those from a lower socio-economic or ethnic minority background are less likely to have access to WiFi or data, which is required for many tech solutions (40, 44).

Interviewees who felt they would benefit from access to skills support emphasised the need to tailor it to particular audiences, which was reportedly not always the case. Others talked positively of receiving support to improve skills through a local charity or library. A notable gap was a lack of access to support around using more specialist types of TEC.

Some interviewees had stopped using technology due to dexterity or other issues, such as being unable to use a smartwatch due to sight loss, struggling to use bulky buttons, or carry out tasks with something worn around the neck. Though there are solutions available to ensure technology is more accessible, people did not always know about them. For example a few people had not heard of voice activated devices – and were interested in finding out more about how these could support them (people did not know how to seek information and advice about this).

One way to minimise inequality of access is to ensure that a range of voices are sought during design, commissioning and implementation through coproduction.

9. *People want to be reassured around privacy and have autonomy around how data is managed*

A key theme across the research is the extent to which technology invades privacy, particularly where behaviour or activity was monitored. A few interviewees had decided not to get an Alexa voice assistant due to privacy concerns, and a sense that someone may be "listening in". The literature shows that those from a lower socio-economic or ethnic minority background tend to report lower levels of trust around what happens to their personal information (40, 44).

Several interviewees referred to CCTV cameras and motion sensors as "big brother" watching them. It is worth noting that this was far less of an issue for current users, who reported being surprised by how quickly they forgot it was there once installed (though some wished to have more control around particular functions, such as the amount of data collected). What was key for interviewees here was being reassured about how the sensors worked, such as not listening in on private conversations. Some also viewed sensor technology as a good alternative to more intrusive forms of technology such as CCTV cameras:

> *"I think my daughter would feel like she was snooping, it's a dignity thing, like a child looking in on parents – what if I eat 5 biscuits (laughs) …but I can see how it could work if you have carers several times a day, so someone can check in from time to time…I have sensors but they can get a bit much, if I am up late you get a message to say 'maybe you should think about going to bed", there were also a lot of false alerts early on, that could be a bit overbearing, but that has improved, there are less messages now it has settled. (Person with care and support needs)*

Some interviewees were willing to forego some aspects of privacy if it meant that they could continue to live their lives independently and reassure family members:

> *"My son has access to a dashboard [for motion sensors] on his phone – he knows when I get up and go to bed, he is part of the bedroom (laughs)…it doesn't affect me as I don't know it is happening…I know he worries and if something happens, within an hour he will be on it…it means we can both get on with our lives."* (Person with care and support needs)
>
> *"My mother in law falls, we put in a camera but she doesn't like it – but we had no choice, as she keeps falling…she doesn't want to go into a care home." (Family Carer)*

Family members described ways in which they ensured the privacy and dignity of their loved ones was maintained where possible, trying to keep a balance so peace of mind was still achieved:

> *"I fitted a CCTV camera in the hallway to see who is coming and going, I can see what [Dad] is wearing and that some days he may not have got changed. I try to respect his privacy and only have this in the hallway… I can log into the camera from my phone." (Family Carer)*

As with all themes – personalisation around levels of privacy is necessary, with one interviewee feeling that there were too many sensors in her home watching her "every activity"

Concluding remarks

It is hoped that this research can help achieve the following:

- TEC suppliers and service providers, commissioners and policy makers adopt a new common language that standardises the way TEC is described, which aligns with how people describe their everyday functions, needs and desires and that these are considered when developing TEC solutions and services.
- The TEC sector builds on best practice and respond to demands for personalised, accessible TEC that comes with choice, and a seamless interaction of different technologies and services.
- That researchers and evaluators build a more robust evidence base around what people want from TEC.

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Appendices

Appendix 1: Codification table with evidence sources

Function categories	How does TEC support these functions
Staying well by being connected to others	
1. **Helping me to stay connected and socialise with family, friends and the community**	There is a relatively large body of research focused on digital connections, particularly for older people, not all are included here. Please see reference for list of resources. **Across all categories of tech**: For some, the use of technology in itself (including reminders, falls detectors, mental health apps), contributes to meaningful and enjoyable conversations, often going beyond checking on wellbeing (50, 63), value of features that allow people to interact through sending photos, text and share with others (12, 15). Need to consider design and implementation features, user friendly appearance and components of implementation sometimes felt to be more important than specific devices used (22, 24), intuitive functions (37). On the flipside – some require reassurance that technology will not be in place of human contact (CS17). If relying on Wi-Fi the quality of connection can have negative impact (22), also need for support to develop skills to build confidence (63) **Smartphone/video:** need to co-design to ensure intuitive functions, needs to be flexible to meet personal preferences, adjustments for any impairments **(**37), ability to interact with people more personally supported take up (59), seen to enhance social interaction regardless of distance (23). Low-income older adults used video calls for socialising because they believed this would benefit them financially – as cheaper than making long distance phone calls (59) **Email, Texts, Skype, Social media** (WhatsApp, Facebook) people like to use a range of these to connect with family and other support networks – an enabler of uptake is that their networks are familiar with these

	kinds of tech and so able to support them to use it, use to connect to people who live far away (60), use driven by need for interpersonal relationships and sense of belonging (59), use Facebook to stay connected to "younger generation (CS17). **iPad:** positive way to communicate with family (36), Skype on Wheels device that could hold iPad and handset enjoy connecting to family – in care homes barriers due to staff turnover, need support as risk averseness, also lack of family commitment and staff attitudes have an impact, also some people required reassurance as they worried they would look silly, or struggle to use features due to impairments. People want device to work across other devices – such as being able to plug into a large screen on a TV that people are more familiar with (22) **Voice activated control**: Alexa – used positively to connect to others and as companionship, reducing loneliness in its own right (26, 63), 62% said Alexa reduced their feelings of isolation (59), positive about a 'drop in' feature – which lets another person using same Amazon account have direct contact through voice communication – offered comfort to family (27) **Telephone/intercom**: some residents still express a preference for the simplicity of a landline phone (63). Wall mounted call systems (e.g., Appello) can be a good way to communication with other residents though some find too complicated, touch screens difficult if have dexterity issues (63) **Social robot**: more positive acceptance after interaction for a period and linked to social capabilities – enjoyment and sociability, companionship and perceived behavioural control (32), higher acceptance of social robot as care companion if affected by loneliness, can offer support and companionship at home (33)
2. Helping me to effectively communicate	**Smartphone or computer (digital tools)**: support young people to write statements and then share them with whoever they choose from support teams – positive feedback that gives ability for voice to be heard (CS27), can use smartphone to dictate and listen to written text aloud- but people struggle with this digital workaround when it comes to health services as the text to speech software on phone doesn't register different formatting on forms (79) **Touchscreen enabled communication device:** find out how people like to communicate - record 'personal preferences (10), give regard to functionality, ease of use, and installation reliability (8), importance of frequent practice to effective use, good if family learn and can all use so they can support person to use to have a voice. Also used to support hobbies (CS41) **Speech generating device**: command with eyes to access Windows environment, additional software offers other functions, using eyes to have phrases read aloud in a synthetic voice, also use to independently search the internet, watch YouTube and Netflix and stay in touch with others (CS40)

	Digital health records: example of a system that allow users to 'tell their story once' in their own words so they don't have to continuously repeat their story to health and social care providers (51)
Living well in and around the home	
3. Supporting me to manage my home environment	**Video doorbell**: unobtrusive way of monitoring family members, reduces falls risk (63), able to make decision about whether to communicate or let someone inside the home (CS24), peace of mind due to increased feeling of security (63). Some felt less suited to shared entrances as intrusive, some require help installing (75), those with particular disabilities require support to maintain – such as charging, also connectivity issues - example of trouble installing doorbell as Wi-Fi didn't extend to entrance of building – this was fixed by fitting a Wi-fi MESH (63) **Beacons:** useful alert if hearing impediment to doorbell – positioning important (63), **Smart lightbulbs, blinds, heating, plugs**: transformed life as no longer relying on family or staff to manage home environment (CS24), improved sleep as turn off lights themselves if night carer forgets to switch off (9), some surprised by relatively low cost of some items and when realised saw as a good investment (75) **Smart sensor lights**: saw cost and energy savings, no longer need to leave bathroom light on during the night (63) **Door entry system**: Useful as able to control who enters the home (9) **Smart door locks/openers:** benefits for those with dexterity or mobility issues and can't use a key (75), More initial caution toward tech which impacts on safety, some prefer cheaper non tech solutions such as a key safe, concerns about lock breaking or WiFi going down (75) **Vibration pads** – good if could be linked with other forms of tech owned (75) **Voice activated control**: Alexa – helps with mobility and reduces pain by allowing to control lights through voice commands (63, 75, CS12), can use to switch off lights when care worker isn't present (39)
4. Supporting me to carry out everyday tasks	**Across all technology:** used to manage various tasks, such as paying bills or doing banking, shopping or groceries or personal items and completing online paperwork which minimised the mobility challenges faced carrying out these tasks (59). Preferences on what types of tech are used depend on number of factors e.g., medication reminders and dispensers – some liked a smart watch, others a reminder clock, a few prefer being reminded by a person as wanted human connection. For apps, banking, smart home devices,

	reminders – main issues and concerns are about how to set up/learn to use (75), some older people need to build confidence – motivated to do as tech becoming more integral to daily tasks (63) **Voice activated control** Alexa –to accomplish a range of daily tasks without a carer, gives sense of freedom and independence (27), becoming more commonplace as can 'self-source' without an assessment (54), can reduce family visits as set up reminders remotely (via a companion app) e.g., for packed lunched, remembering appointments, also reduced anxiety for family carer (26). As a support to a neurological condition refers to supporting independence use for online shopping, reminders – part of daily life (27), medication reminders (63), value that it can be used with other smart home devices – can enhance other tech such as smart bulbs, heating, reminders, shopping (75), freedom for family member to get on with other tasks, don't need to rush home as reassured (63). There are some concerns around Amazon holding data – such as care based conversations – easy to delete but some still have concerns (27) **Smartphone/tablet:** most already use these for entertainment, games, staying in touch (75), high age related heterogeneity of learning time, performance speed, error rate, and subjective satisfaction - technological products and design for older adults, more important that it is simple and easy to operate (42), **Smartphone Apple pay:** good if unable to manipulate small items like money, less need for someone to accompany when going shopping, values the freedom this offers (CS24) **Smartwatch**: like that it looks like a 'normal' watch with added functionality (52) **Orientation system** with message on computer screen to inform of time of day and various tasks and planned activities – decreased anxiety as fewer late night calls to family (8) **LMSU! – digital tool**, positive as can be used across devices, including desktop computer and as a mobile app – described as giving control over life banking online, arranging outings, ordering takeaways, described as 'levelling the playing field', and integrating smartphone with head switch tech changed life (CS25) **Robotic vacuum cleaners** can carry out tasks such as cleaning without relying on onsite staff (63) **Automated handwash/medicine dispensers/jar openers –** like that people can do things independently, needs to be user friendly, simple to use (8, 59), some need help filling up, or prefer non tech solutions (dossett box) (59, 75). Reminders help carers worry less as tech is reminding to take medication (63), reliability important: avoid errors on a medication reminder – yet another thing for family to deal with (76), need to be reassured around safety aspects (75).

	Monitored medication dispenser: additional reassurance as alert raised to a monitoring centre, then family can get in touch and go through what to do, referred to as a relief, ability to go on short holiday (CS18)
5. Providing (assistive) support when I need it outside the home	**This relates to support around public transport, assisted volunteers. Limited evidence identified here – though it may be that it was not captured through the rapid review search parameters. **Smartphone/other digital device:** usage for checking directions and bus schedules and checking the news and weather may be driven by safety needs in terms of mobility and traveling (59),
6. Supporting me to keep mentally well and do things I enjoy	**Across general tech:** people use various devices for range of hobbies and learning (59), low income see internet as opportunities to develop life skills and personal growth (59), in care homes lack of digital infrastructure can make it difficult to utilise technology that relies on Wi-Fi connection (29), some reluctant to use internet due to fear of privacy breach or scams (63) **Voice activated assistant:** Alexa – can enjoy hobbies where condition means hard to do things manually (27), rely on a wi-fi network and mains power, and thus are vulnerable to outages. In a scenario where a user is heavily-reliant on their assistant, this could create unacceptable inconvenience (27) **Smartphone apps**: positive - a button which was pressed when someone felt in need of conversation and linked them by phone to someone else in a group who they could chat to.(35) **Kindle**: adaptable for those with dexterity or sensory impairments (CS17) **iPad/tablet**: good tech to use in care homes – helped independence – one used to book bowling trip for the whole home (36), crosswords, good to keep mind busy, use for video calls, find music on YouTube, family photos (CS5, CS51) can offer multi-sensory experience compared to traditional media – valued by people with dementia – use for memory and reminiscence, versatile and flexible in how set up, for those in care homes can support more self-directed activity (29), touchscreen more beneficial for those less familiar with modern devices like PCs – feels more intuitive **bespoke apps** need to be developed with simplicity, and designed around needs of people with specific conditions – such as dementia (29) **Video**: virtual quizzes - people appreciated conversations with people outside of the care home setting, felt connected through playing a game – assisted reminiscence and sense of self, compared positively to watching TV (30)

Living safely in and around the home	
7. Providing access to help when I need it urgently **8. Providing (urgent) support when I need it outside the home**	**General telecare**: provides vital "back-up" needed to feel confident about living independently (or being "allowed" by others to continue doing this) (56), belief that it will make life safe is one of main reasons people consider buying a product (31), the degree to which people feel empowered in decisions about care and support critical in shaping perspectives (56), family have better control over own lives - enjoy a social life, go to work knowing person can summon help if needed (20), improved relationships by providing reassurance between visits and forging stronger links between neighbours listed as responders (56), key motivator is to relieve worry of family members (CS19), people value additional wraparound service and check-in calls (CA1). Carers also value regular and proactive 'check ins' to ensure they are okay, to show they care (CS4 CS6, CS7), preference for unobtrusive designs (3), any user interface needs to be stable and easy to navigate, with large text (61), some unclear about how to use as had installed during emergency – may not use device without additional support (76) reluctance to use as don't want to bother people, particularly if late at night (73). Those which require actions – such as pressing a button, are less suitable without significant support from a carer (19), family often required to charge batteries, reminding a person to wear their pendant or pick up a fall detector, carrying out simple telecare maintenance checks or setting up a GPS device (55), if relies on internet connection seen as less reliable or trustworthy (75) **Off the shelf technology** is preferred by some, considered more aesthetically pleasing and less stigmatizing than traditional telecare devices (39), families have complex arrangements with technologies in place, including laptops, smartphones, tablets, webcams and home CCTV cameras linked together to create bespoke 'telecare' systems. Some see 'home-made telecare' as superior to telecare provided by local authority – seen as cheaper, more informal and greater ability to tailor to needs (bricolage) (55) **Fall detectors**: ability to live independently and the perceived need to ensure safety is main motivation to use (54, 63),offer peace of mind that tech provides quicker response if fall, for person and family (63), value of 24/7 monitoring centre that can send help if required (CS3, CS6), gives family greater freedom (54). Reference to 'inaccurate measurement' being either too sensitive or not sensitive enough to record a 'soft fall' (76), and frequent false alarms (8), if placed in a crisis (e.g., after a fall) may forget how to use if no follow up (55), some misused an alert system to exercise control, such as by manoeuvring on the floor in the event of a fall, to prevent alert signals being sent to family, so as to avoid hospital time. Some adults discontinued use because they felt "uncomfortable, fearful and 'spooked'" by the passive monitoring (60), generated frequent false alarms, e.g. if a person stood up or sat down too quickly (73), abandonment more likely when low batteries, connectivity issues, and alarm fatigue due to false positives (8). **Pendants:** some refer to using alongside other types of tech – such as an Alexa – together this provides reassurance for family (63, 69), choice and ability to impact on outcomes important - such as who is

	summoned to help when pressed e.g., not a family member if at night (56, 76). There is need for clear guidance, some forget instructions - led to confusion and abandonment of pendants (e.g., could it be worn in shower, who is alerted when activated) (56). Many do not use as directed, wearing can lead to stigma and embarrassment (6), appearance an issue for many – described negatively (54, 55, 56) incongruent to general appearance, could be uncomfortable and cause chaffing - some tuck it beneath clothing – which can affect usability (76), some use for benefit of carers and then take off when alone (76), or them often being out of reach so they can be difficult to activate in an emergency (56), not wishing to be a burden so reluctant to activate as don't want to be a nuisance (27, 56), young women prone to falling – felt stigmatised by pendant alarm – so linked a video calling portal to a voice assistant instead (C10). Being involved in the decision making process mitigated negative perceptions to some extent (56). **GPS pendants/tracking devices** supported ability to go out unaccompanied – enhanced feeling of safety (55, 63, CS16), family feel reassured and can communicate when person outside (CS15), preferred by people with dementia (43), meant family member could remain in paid employment for longer (55), boost confidence and independence by enabling people to go out for longer, or on their own; enhance a feeling of safety as can press for help if get into trouble (63, C52), value this device as it does prompts via text message when battery is low, or when switched off (CS2). Problems of interoperability and levels of technical skill required to connect could limit use (55), person with dementia happy to wear, but requires family support (CS2), can send false alerts, only work if good, reliable service behind them (63), some need support from family to use, such as leaving in familiar place to remind people to put on before going out (55), family member found it supported adoption when tracking device was described in words that explain the outcome, e.g. as something that can enable you to go out on your own and makes sure you don't get lost (74) **Sensors** (**property exit, heat, bed**): help family of children with LD to get good night's sleep and enabled family to stay together (CS20), preferred a **bed sensor** to a **pendant** due to it not being used and not being able to reach when fell awkwardly, more peace of mind (CS19), found to have a preventative effect due to influencing self-awareness – resident used to actively strive to avoid falls as awareness of sensors meant more conscious of movements (63) **heat sensors** when 'dropped in' with little ongoing assessment of need – meant limited understanding of what it was for (55) support around acquisition of new rituals' – **bed sensor** – had to rush to get back to bed before an alert triggered (76), **Sensors worn on the body:** 94% of people with Parkinson's disease were willing to wear body worn sensors at home, preference for something small and to look like an everyday watch (6), more likely to consider appearance if wearing outside, prefer not to be noticeable in public (6),

	Smartwatch offers added security, can press button if have a bad fall and helpline will get in touch, check okay and call family if needed (52), helps people feel independent as can call for help if needed and use for fall detection, reminders to move (convenient as attached) (75), barriers are: requires a smartphone, also usability and size – for some a benefit – for others a limitation as difficulty reading display, dexterity issues (75). **Voice activated assistant**: can use in emergency if phone or other items out of reach (27) **CCTV camera (Wi-fi):** older adults indicated that they would be willing to forego what they would consider an invasion of privacy to keep themselves safe at home and avoid residential care (such as through fear of falling) (61), raises privacy and ethical concerns – trust is lower for lower socio economic groups (44) **Emergency pull cord** not sufficient if people can't get to it (61) **Helpline button** (attached to a pendant or wrist strap) offers peace of mind as receive right support when needed (CS7). Can't always wear it – such as taking off for a shower (CS7), having trust that respondents will help when needed is important (3) **Response teams**: essential to the functions of technologies (63), people value being reassured that there is a backup person (75), response will be fast (CS1), that someone is at the end of a phone (20), prefer dialogue rather than purely to summon help (39), people value check in calls even if no alerts (CS1), family improved health and wellbeing as no longer feel 'on call' all of the time (20), like to feel less of a burden on emergency services (52), response needs to be rapid – particularly if frequent faller, valued if responder arrives quicker than an ambulance (20).
9. Helping me to move around safely at home	**Aids and adaptions:** providing ability to age in place top reason given for using these (78), enables areas that would otherwise be 'out of bounds' (staircases, upper floors) to remain accessible as feel safer using them, family reassurance (56), important to consider whole picture from choosing, to installation and ongoing maintenance checks, reliable and timely repairs (54, 55), 'institutional or medicalised looking' items in the home very unattractive and stigmatising, practical issues such as ease of cleaning, ease of access, reliability and ability to tailor to need important (54, 77), weak practice where too little or too much technology (77), high cost can be a barrier to accessing equipment or services (54) To note – a full review of what people want from Aids and Adaptations (e.g., Non-tech/tech shower chairs and stools, bath lifts, raised toilet seats & frames, grab rails, and mobility aids, welfare checks, regular check-in calls) was not carried out as it went beyond the scope of this work.
Access to quality information, advice and support	

10. Supporting access to information and advice when I or my family need it	**Access to tech expert/independent advisor:** A lack of awareness or recognition of more specialist TEC, though suggestions that some may be interested if knew about it (21, 31, 54, 55), some do 'ad hoc' off the shelf solutions (21) – help to identify right 'kit is desired by many, need to trust advice is independent (31,73, CS8), want that 'personal touch' if a self-funder looking to buy equipment (CS21). In a CarersUK/YouGov poll, there was very low awareness of telecare technology, with only 12% of the population saying that they would use it. When the term was explained to them, 79% of people said they would use it and this was even higher for the over 85s (73), family express interest in help to navigate assistive tech landscape (21), hindered sustained technology use because technical assistance is imperative for low-income older adults who have lower computer and Internet proficiency (59), positive charitable examples of helping people identify the right products for them (21) **Demonstrator sites:** the availability of access points (e.g. high street), which in turn offers the potential for demonstrators, and support (31), people want more information and opportunities to learn about tech which could support them to live independently in "real life" environments so they can consider whether it will work for them, value being able to see something working in situ, within a reasonable timescale and in a convenient and accessible location (31, 74, 75). For uncomfortable and insecure users, demonstrating and allowing people to try out tech before purchase allows users to rapidly adapt to new products (42). This is especially important as some people reported that they did not know if something would be right for them until they tried it out (75). Other successful initiatives included a loan scheme to give people the opportunity to trial devices without the pressure to immediately commit (53) **Digital hub models**: useful model for people to access support around digital health literacy more general (25), helps self-advocacy for family members, can be digital (72) **Language:** Simplified service contracts for broadband, with clear costs, easy access to security checks to protect against fraud. Need for quality advice: barriers include fragmented pathways for info and advice – need consistent language, avoid jargon (54), **Training and support around skills and literacy**: charities and schools across local communities offer training courses, resources and community initiatives (34, 75), some assisted living facilities also offer this (63) **Websites/online resources**: examples of charities which offer websites with selection of products being tested, support around applying for grants – valued as family members struggle to find the time to navigate this (21), negative reports of websites for self-funders about what equipment to buy being basic (CS9), young people want online resources to be mobile first to suit smartphones (48). Consider visual

	representations, language – be reflective of different cultural groups, whilst avoiding stereotypes – important (44) **Voice activated assistant:** some prefer over a website for information search, as more convenient (28) **Social media**: popular with young people to advertise health-related messages and promote TEC solutions (51) **Peer led approaches**: examples of charities which offer online advice based on lives of people with lived experience (55), online resources which shared stories and reviews of using tech for people with lived experience helps build confidence around navigating what will work (29, 31), hearing positive experiences helps with decision making around what to purchase (74), good practice examples of family carers creating resources via social media to providing signposting to dementia and age friendly apps (25) **Digital health records**: Lack of knowledge around data privacy for young people – only 19% in survey felt it would be easy to access their medical records (51), ensure records are easy to access and bring records together in one place with guidance on how to interpret the information, give shared control over who can access the account and allow to contribute to notes about experiences (51). **Access to ongoing information and support:** young people say they need care staff who can act as advocates for TEC – support colleagues to see benefits too, to troubleshoot and be a point of contact (51), physical and online manuals, information about upgrading if needed (75), likely cost to install and run it, to cover the risks of repairs and breakdowns, ease of maintenance and insurance (74) **Guides/libraries**: Dummy guides – such as how to 'Skype', a one page easy to follow for family (28), a 'What to Expect Guide' useful for young people, could be in different formats, although efforts should be made toward multimedia information rather than just text. Videos can be particularly useful in providing information to young people who would otherwise struggle to read lots of text (51). NHS app library described as useful but not widely known about, and not fast paced enough to keep up with the market, 70% more likely to use an app if approved by NHS (51)
Monitoring and managing own care, health and wellbeing needs	
11. Helping me to monitor and keep track of my health and nutrition needs	**Telemonitoring:** supports earlier intervention compared to if it was not in place (62), empowered self-management by enhancing understanding of health, and providing additional justification for decisions to adjust treatment or seek professional advice (7), family appreciate telemonitoring equipment that is simple to use and does not add any inconvenience or additional stress (62). Reference to technologies to support

12. Supporting me to manage my own care and support needs	self-management of care are narrowly defined, some unable to use Direct Payments to fund what they perceive as best (39), importance of co-designing to ensure useful and accessible to target groups, difference between younger and older people (13. 16, 44, 48, 49, 62). Barriers around inability to adapt technology to devices already being used, and need to customise and personalise self-management tools (47, 49, 50) **Home monitoring devices**: value flexibility and time saving elements, fit into daily life, easy to use at a time which fits around daily routines and visit health services less (16, 62, 64, 70), good if there is access to professional feedback for reassurance (16, 66, CS21), people value learning about conditions, improves insight and self-control across range of conditions, able to monitor changes over time and feel more independent (6, 50, 57, 62, 68), and proactively make changes to lifestyle and eating habits (57). Negatives around frequent need to recharge batteries (64) **Self-management apps or smart applications:** can be installed on any mobile device (4), young people like as integrates into their daily life (50), empowers as justification for decisions to adjust treatment or seek professional advice, reduce unnecessary health visits (6). **Telecare apps** – help people to live independently and reduce stress, good to download apps which can support keeping to routines, family able to log in and feel reassured person is looking after themselves, flexibility to tailor to needs (16, 62, CS23), technology-empowered CBT useful tool for young people that were embarrassed to talk to a practitioner about their problems (49), promotes self-efficacy (6). Type 2 diabetes: 57.8% of the respondents in a mobile weight-loss and lifestyle intervention said promoted their self-efficacy (6), some like proactive text (16) and access to peer support to build confidence (13), interest in connecting a fitness app to Facebook or other social media to share with friends (15), for young people with chronic pain, 75% said their condition affected their mental health and 100% said that TEC which helped them track their condition would be useful (51). Some apps – such as those aimed at people with mental health may be less suitable for those with more severe symptoms (50), some specialist apps will need onboarding support (13, 44), ensuring service provider is in the loop to discuss results or concerns increases sense of security (4, 13). Need for individual tailoring reported in 57.8% of the respondents in a mobile weight-loss and lifestyle intervention for patients with type 2 diabetes, need for operational flexibility (6), general requirement for more autonomy in editing and planning to ensure more person-centred (13), if apps not compatible a frustration – e.g., calendar feature not syncing with other apps or tech programmes (13), problems with connectivity for apps that are used when outside a barrier, due to restricted Wi-fi access in some premises (13), attitudes toward self-tracking and monitoring are related to people's socio-economic background in several studies, with some groups who are already disadvantaged reporting trust in services being lower (44)

	Wearables: particular features liked across groups, such as motivational messages for fitness apps (49), has a good acceptance ratio for well-educated older adults that appreciate the possibility of self-monitoring their health status (32). Young people want ease of use, comfort, aesthetics important, perceived accuracy of devices of less concern, access due to low socioeconomic a barrier such as ability to sync and access data at home. Study where data was prioritised for entertainment over the app (40). Peer championing led to additional demand for Fitbits (12), older people viewed that fitness tracking devices tend to be developed with younger people in mind (42), importance of personalisation and input into design, variable by income and age (15, 40) **Spotify:** favourite playlist utilised to support people with Autism through sensory overload (13) **Hydration cups, tip kettles**: people value the preventative element reminder to keep hydrated. Ease of use, practicalities, design are important – as is portability – as unable to use in areas without WiFi (63) , safety important. 'tipper kettles' motivation to use was it was a small thing that made a dramatic difference (12)
13. Supporting me to interact with health and care providers	**Remote assessments: use of smartphone:** happy if it can speed up process of e.g., allocating appropriate adaptations (18) **video:** family members prefer if it meant loved one could be seen by a specialist sooner, or more often (38), flexibility, offer alongside face to face options (4), works for those who work, are housebound, have significant caring responsibilities, live a long way from the surgery or who have mental health needs, teleconsultation was appealing as it resulted in saved time, transport costs and anxiety (4), convenience for family carers (62). Some patients could not use it due to severe illness, physical conditions of the home, lack of interest, or concerns about the equipment (46), inability to do physical examination a concern- may need staff help (38), may not have the skills or ability to interact with video streaming or other technological aspects. Most service users indicated that they would like to use WhatsApp for video streaming; however, security risks around the use of the platform persist (18), sensory impairment, dexterity – accessibility of invites to video consultations (79) **Wraparound service:** need staff to be available to support use of technology, reassurance that there is access to alternative options when things go wrong (79] **Voice activated assistant:** Alexa increasingly being used to support needs but , issues around data, ownership of resulting data and ability to use the collected data pose challenges to their adoption within social care services (78)

Proactive support to maintain care, health and wellbeing	
14. Early intervention is available when I experience changes to my physical needs and behaviour	**Passive monitoring sensors:** peace of mind was a major theme, perhaps the biggest advantage of telemonitoring. The words 'reassurance', 'safety net' and 'comfort zone' were expressed repeatedly (62, 63), older adults adopted a remote monitoring system because they perceived the need to be 'doing the right thing' to reduce family burden (59), can carry out daily tasks with less anxiety (62), receiving early triggers or warnings felt to help avoid crisis and avoid unplanned use of health services (62), reduced constant check-ups from worried family members (63), person and family like to access data dashboard and interpret data themselves (1,19), like that technology can potentially pick up data that staff may miss (8), or spot things earlier (63). Preference to link with other forms of technology already used (63), want interface to be simple, integrated and accessible via a single tablet (41), acted as an early warning system -infections were picked up by triage nurses because readings were observed daily, allowing treatment to be started quickly (62). Privacy concerns are most commonly identified barrier to acceptance as it involves collecting sensitive data (8, 32, 63), family in particular concerned about security and privacy of personal information collected, need to balance what collected so doesn't impinge on privacy (61), concerns that it is threat to autonomy – some discontinued use as believe it was programmed with certain assumptions about how they would or should live, at times triggering unnecessary signals (60), requirement to control what is shared e.g., notify when something is unusual, rather than informing of usual activities – so less information to sort through (61). People want to have a say in what data is collated, how used (61). Adoption less likely if older person experiences loneliness or perceives they will lose support from caregivers (32), good for people living with dementia as no action is required (19). Sensors not suitable for people who do not live alone as can't distinguish between individuals in the living space (19), older immigrants more reluctant to adopt due to culturally embedded value, more likely to adopt if lacked family support (59). Ensuring operational requirements clear and realistic e.g., if sensors need to be plugged in, or stop working if run out of battery, also requirements of staff or others to be able to interpret data (19), concerns around need for internet connection, broadband service, WiFi access could hinder use (64, 69), some viewed tech which relied on internet connection as less trustworthy and reliable (19, 75), **Mattress sensor:** good to see data and monitor sleeping patterns (63), **Plug-in sensors**: to track ' use of cookers and microwaves - bulky and space-consuming can impact on use, such as for those with shaky hands (63). **Mobile phone**: texting and emails -used by family to monitor older adult's well-being, daily welfare check (61)

	Monitoring centre/platform: family reassurance that someone else is involved (62, 73), people appreciated their data being monitored by professionals who would take action if they saw irregular signs (6), some concerned about costs of a subscription (64, 69, 75), responsive human element important – positive if perceived as friendly, supportive and proactive (62), for those with learning difficulties potentially mitigate anxiety around isolation and reduced staff visits (9). Reliance of a system on user's ability to communicate with an operator impeded adoption of a sensor based remote monitoring service system (59)

Appendix 2: List of evidence reviewed

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