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Jacqueline Damant, Martin Knapp, Paul Freddolino and Daniel Lombard

Effects of digital engagement on the quality of life of older people

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Effects of digital engagement on the quality of life of older people

Abstract

It is often asserted that older people's quality of life (QOL) is improved when they adopt information and communication technology (ICT) such as the internet, mobile phones and computers. Similar assumptions are made about older people's use of ICT-based care such as telecare and telehealth. To examine the evidence around these claims, we conducted a scoping review of the academic and grey literature, coving the period between January 2007 and August 2014. A framework analysis approach, based on six domains of QOL derived from the ASCOT and WHOQOL models, was adopted to deductively code and analyse relevant literature. The review revealed mixed results. Older people's use of ICT in both mainstream and care contexts has been shown to have both positive and negative impacts on several aspects of quality of life. Studies which have rigorously assessed the impact of older people's use of ICT on their QOL mostly demonstrate little effect. A number of qualitative studies have reported on the positive effects for older people who use ICT such as email or Skype to keep in touch with family and friends. Overall, the review unearthed several inconsistencies around the effects of older people's ICT use on their QOL, suggesting that implicit agreement is needed on the best research methods and instrumentation to adequately describe older people's experiences in today's digital age. Moreover, the available evidence does not consider the large number of older people who do *not* use ICT and how non-use affects QOL.

What is known about this topic:

- Some research indicates older people's use of email and Skype positively affects their QOL by enabling them to keep in touch with friends and relatives
- Research suggests mobile phone ownership can have a positive effect on older people's sense of safety and security

What this paper adds:

- The empirical evidence demonstrates that the effects of older people's use of ICT, for both mainstream and remote care purposes, on different domains of QOL can be both positive and negative, challenging common assumptions that ICT is unquestionably beneficial
- Highlights the strengths and limitations of different research methods used for generating evidence on the effects of technology use on QOL

Introduction

The impact of new Information and Communication Technology (ICT), such as mobile telephones, computers and the internet, on the lives of older people is unclear, with both positive and negative views expressed. We review evidence on the impact of ICT on quality of life (QOL) of older people, with respect to both their day-to-day lives in general and their health and social care needs in particular.

Methods

We undertook a scoping review, adhering to guidelines outlined in Arksey et al. (2005). Initial searches were conducted on August 8 2012 in databases focused on relevant disciplines including ICT and communications (Library, Information Science and Technology Abstracts, Communications and Mass Media Complete), social sciences (International Bibliography of Social Sciences, PAIS International, SocIndex Full text, Web of Science Core Collections), psychology (PsycINFO), and health and social care (CINAHL Full text, Pubmed). The database review was restricted to peer-reviewed journal articles published between January 2007 and August 2012. Searches were repeated on August 15 2014 to identify articles (published between January 2012 and August 2014). Boolean terms for the search are described in table 1.

Table 1 here

Searches yielded 1129 unique references. After screening titles, abstracts and full texts, in turn, for relevance in terms of older people's access to ICT and effects on QOL, the final selection included 91 key articles. We included articles discussing a broad range of ICT used by adults explicitly described as "older", "elderly" or "senior citizens". Main reasons for exclusion included no reference to ICT usage, no analyses of older adults, and studies in tertiary care settings. Studies were also excluded if the primary outcomes focused *solely* on technical feasibility of the ICT system, changes in vital signs, changes in use of health and social care and use of ICT by care staff.

We supplemented the database search with hand-searches for policy documents and reports from organisations such as Age UK, International Longevity Centre-UK, Department of Health, Social Care Institute for Excellence (SCIE) and Ofcom. Other literature sources were identified through bibliographies of journal articles and reports. Supporting evidence was sought by using the Google search engine, with search terms such as "quality of life" AND "older people" and "technology".

Definitions

What is mainstream ICT?

We define mainstream ICT to be contemporary generic technology devices, services, applications and internet platforms used by large proportions of the population in Britain as indicated by OfCom (2014). It includes internet networks, mobile phones, smart phones, computers, and tablet computers.

What is remote care?

Barlow and Knapp (2014) define remote care as "assisted living" technologies which use ICT devices and telecommunications network to deliver health and social care remotely – often in someone's home. It includes overlapping concepts such as "telecare", "telehealth", "telemedicine" and "smart homes" (Barlow et al., 2012) which represent the range of remote alert, monitoring and consultation services currently deployed within health and social care systems . Emerging concepts such as "mCare", "mHealth" and "wellness services" also embody the notion of remote care. mCare (or "mHealth") uses mobile devices as the gateway to services (Telecare Services Association, 2013a). Wellness services refer to ICT applications that promote healthy living and include technologies which stimulate cognitive and physical fitness, as well as "social robotics" designed to facilitate social exchange (Carretero, 2015).

Telecare is defined as 24-hour remote support and assistance provided through alarm and monitoring equipment (e.g. pendent alarm, enuresis pad), permitting detection of (and response to) personal emergencies (e.g. falling) and adverse home events (e.g. bathroom flood) in real-time (Telecare Services Association, 2013b). Smart homes refer to the range of "domotics" devices consisting of sensors, actuators and other wireless technologies, also referred to as advanced forms of monitoring and alert telecare services (Kubitschke and Cullen, 2010). Telehealth is the remote transmission of vital sign data (e.g. blood pressure) between patients and health care professionals. Data are transmitted using peripheral ICT devices (e.g. pulse oximeter) for clinical review via telephone line or broadband internet. Telehealth services facilitate detection of abnormal patterns in vital signs and instigate interventions to prevent deterioration of health (Telecare Services Association, 2013c), without patients having to present themselves at face-to-face appointments (Department of Health, 2011). Telemedicine refers to use of ICT (e.g. videoconferencing) between healthcare professionals and patients, for remote consultation, diagnosis and treatment services (European Commission, 2009).

Data analysis

To analyse outcomes of using mainstream ICT and ICT-based care, we adapted the Adult Social Care Outcomes Toolkit (ASCOT) (Netten et al, 2011) and WHOQOL (The WHOQOL Group, 1998) models. Both frameworks are internationally recognised and incorporate similar dimensions and facets, but diverge slightly in focus.

ASCOT measures social care-related QOL. Based on Sen's (1985) study of social capital and capabilities, it measures individuals' choice and control with respect to social care, rather than functioning. ASCOT emphasizes individuals' *capabilities* (Box 1).

Table 2 here

WHOQOL is based on a multidimensional perspective of QOL, applicable to varying circumstances and cultures throughout the world. It assesses how individuals *function* across a range of living environments (Table 3).

Table 3 here

The capability approach in ASCOT can be used to assess effects of ICT use on individuals' ability to live the life they choose. Some ASCOT dimensions are less fully defined for our needs here; e.g. dignity focuses primarily on self-esteem, whereas other emotions (e.g. anxiety, fear, contentment and optimism) are also relevant. There is also no domain measuring QOL aspects which reflect *physical* capabilities. Therefore, we draw on the WHOQOL framework for domains and facets complementary to ASCOT.

Our combined QOL framework has six dimensions (Table 4), four from ASCOT (control over one's life, personal safety, social participation and involvement, and occupation), slightly amended to incorporate complementary facets of WHOQOL, and two (psychological wellbeing and physical health) primarily based on WHOQOL. Psychological wellbeing is an expanded version of the ASCOT dignity dimension, including a broader scope of feelings suggested by WHOQOL. The physical health dimension and related facets combine the WHOQOL model and items developed specifically for this research.

Table 4 here

We used a framework analysis approach from Gale et al (2013) to examine the literature, coding deductively according to our six dimensions (Table 4).

Findings

Table 5 summaries studies which provided evidence on effects of ICT use in both mainstream and remote care contexts. A wide range of both qualitative and quantitative research methods and instruments are employed across many studies with varying effects. We now describe this evidence for each of the six QOL domains in turn.

 Table 5 here

1.   Control over one's life

Control over one's life includes dimensions from ASCOT including "personal cleanliness and comfort", "food and drink" and "accommodation cleanliness and comfort" as well as elements from WHOQOL including "independence", mobility and activities of daily living (ADLs). The domain therefore includes indicators of ability to manage ADLs (e.g. personal hygiene, dressing, feeding) and instrumental activities of daily living (IADLs) (e.g. shopping, cleaning, preparing meals).

Mainstream ICT

Evidence suggests that using computers and the internet gives older people a greater sense of independence and control over their daily lives (Morris et al., 2007; Selwyn, 2004). Mason et al (2012) discovered a significant association between internet use and perception of control. Slegers et al. (2008) found that older adults who used their computers often showed a significant increase in sense of control over life over 12-months, whereas those who used a computer only occasionally had a significant *decrease*. Martinez-Pecino et al. (2012) reported that older people who own a mobile phone felt a sense of freedom and independence.

With respect to specific IADLs, Selwyn (2004) described anecdotal evidence of perceptions of how ICT helped individuals to keep their house in order and do shopping. Koopman-Boyden and Reid (2009) on the other hand, found no significant relationship between internet and email use and satisfaction with physical environment, and Harrod's (2011) qualitative evidence suggested that older people felt pressured to demonstrate their ability to use ICT for shopping and banking to deflect the societal stigma of being dependent.

Leppel & McCloskey (2011) found no significant differences in attitudes concerning usefulness of online shopping between younger and older groups. They also found that adults aged 50-69 made more online purchases than those aged 18-25 and those aged over 69. Those in the older age group rarely made online purchases, but did search the internet for information about goods and services.

An emerging theme around independence and control was use of mainstream ICT to prepare for the future. Selwyn (2004) discovered that older people sometimes adopted mainstream ICT applications (e.g. email, Internet shopping and banking) pre-emptively. In other words, some younger-older people adopted ICT in preparation for a future when they might have less control over their ADLs and IADLS as a result of being less mobile or having more financial constraints.

Remote care

Underpinning "ageing in place" policies is the promotion of independence, enabling older people to continue to live in their own homes supported by ICT-based care (Matthews et al., 2010; Sixsmith and Sixsmith, 2008).

Frost et al.'s (2010) review of ICT-based care reported qualitative evidence showing positive effects of ICT-based care on independence, in terms of improved mobility and ability to carry out ADLs. Brandt et al.'s (2011) review of telecare and smart home services found few studies which assessed effects of ICT-based care on IADLs. Overall, ICT-based care interventions tended to have positive effects on independence and ability to perform IADLs. Age UK (2010), Milligan et al. (2011) and Matthews (2010) also noted that ICT-based care empowered (older) people with disabilities by compensating for some physical impairments, which otherwise prevented them from managing their ADLs.

Quantitative evidence concerning the effects of use of ICT-based care on ability to carry out ADLs and IADLs was limited. Brownsell et al. (2008) noted that using telecare services had no significant effects on ability to carry out ADLs. Nijland et al. (2009) found no difference between older and younger people using an email consultation service to contact their GP in terms of felt control. Damant et al. (2013) noted that more people participating in the MonAMI study perceived telecare services to be helpful rather than unhelpful in performing day-to-day tasks, shopping, and personal care; there were no statistical differences between the number of respondents who found the services helpful - and unhelpful - in the areas of meals and nutrition; or maintaining their home environment.

2.   Personal safety and security

The "personal safety and security" domain is derived from the ASCOT "personal safety" dimension and the WHOQOL "freedom, personal safety and security" facet from the environmental domain. "Privacy" was added as it is related to issues of security, particularly regarding the internet.

Mainstream ICT

Several studies reported large proportions of older people owning a mobile phone for emergency use, with positive effects on sense of personal safety (Martinez-Pecino et al., 2012; Plaza et al., 2011; Walsh and Callan, 2011). Conversely, several sources found negative effects of ICT on sense of privacy and personal security (Garceau et al., 2007; Gatto and Tak, 2008; Leppel and McCloskey, 2011; Mason et al., 2012).   Some authors further exposed fears about becoming victims of abuse and crime when using ICT, and subsequent negative effects on personal sense of security.

Remote care

Under "ageing in place" principles, providing older people with a sense of personal safety and security is a fundamental purpose of ICT-based care (Mahony and Mahony, 2010; Milligan et al., 2011; Plaza et al., 2011). Several studies described the positive effects of ICT-based care on older users' perception of safety. Williams et al. (2010) reported that 76% and 65% of respondents rated the localisation and emergency alarm applications respectively as "important". Brownsell et al. (2008) found that people in receipt of fall detection and lifestyle monitoring services reported improved feelings of safety compared to people without such services. Participants in a study by Walsh & Callan (2011) felt reassured by having pendant alarm services. Turgeon-Londei et al. (2009) found that 96% of participants were favourable to video monitoring services that ensured personal safety in their homes. Chou et al. (2013) reported high ratings for "feeling safe in daily life" amongst telehealth recipients. The MonAMI evaluation (Damant et al., 2013) showed that a significantly greater number of participants perceived the technology services to be helpful rather than unhelpful for improving sense of safety and security in terms of falling, intrusion in the home and protecting belongings.

Several sources discussed intrusiveness of ICT-based care and related effects on privacy and personal security. Monitoring services, in particular, raised suspicions that "Big Brother was watching", which could impinge on sense of personal freedom (Age UK, 2010; Chan et al., 2009; Demeris et al., 2009; Lorenzen-huber et al., 2011; Mahony and Mahony, 2010; Matthews et al., 2010; Milligan et al., 2011; Wright and Wadhwa, 2010).

Concerns regarding safeguarding of privacy were reflected in anxieties. Williams et al. (2010) found that 63% of participants were either "very concerned" or "slightly concerned" about lack of privacy from 24-hour monitoring services. A further 59% expressed concern about sending data to non-medical staff for fear of crime and maleficence. Turgeon-Londei et al. (2009) reported that 60% of their sample expressed a sense of intrusiveness into their private lives when considering the use of video-monitoring equipment. Results from Nijland et al. (2009) also showed that 46% of the total

sample (including younger adults) had doubts about the level of privacy of the email consultation (telemedicine) service. There was no significant difference between older and younger respondents.

3.   Social involvement and participation

Social involvement and participation refers to the types and extent of personal relationships in which individuals engage, and how they maintain these relationships.

Mainstream ICT

Several sources noted that the primary benefit of older people's use of ICT was ability to maintain relationships with friends and family, and thereby gain social support (Age UK, 2010; Bobillier Chaumon et al., 2013; Choudrie et al., 2010; Weaver et al., 2010; Wright and Wadhwa, 2010).

There was considerable evidence of the positive effects of a range of ICT on social involvement with friends and family. Woodward et al. (2011) found an increase in perceived support from friends from older people participating in ICT training. Positive effects on social networks were associated with their use of mobile phones (Hurme et al., 2010; Martinez-Pecino et al., 2012; Plaza et al., 2011; Walsh and Callan, 2011), Skype (Woodward et al., 2011), email (Blažun et al., 2012; Gatto and Tak, 2008; Mason et al., 2012; Sayago and Blat, 2010) and the internet more generally (Adams et al., 2005; Gatto and Tak, 2008; Hill et al., 2008; Independent Age, 2010; McMurtrey et al., 2011; Morris et al., 2007; Sum et al., 2008).

A secondary benefit of use of ICT to maintain involvement with families was described in terms of improving inter-generational relationships (Adams et al., 2005; Bailey and Ngwenyama, 2011; Hill et al., 2008; Holladay and Seipke, 2007; Hurme et al., 2010; Plaza et al., 2011; Sayago and Blat, 2010; Woodward et al., 2011).

The effect of use of ICT on reducing loneliness was also a prominent theme in the literature. Mason et al. (2012) reported that older non-users of the internet were significantly more likely to say that they felt lonely compared to users. Similarly, older internet users stated significantly more often that they hardly ever felt lonely, compared to older non-users. Tsai et al. (2010) found that older people living in residential care significantly decreased their level of loneliness from baseline to follow-up when using video-conferencing equipment. Blažun et al. (2012) found that older people who used email and online forums, and who participated in a computer training course, significantly reduced their levels of loneliness. However there was no reported change in level of loneliness amongst participants who used Skype. Erickson and Johnson (2011) report a significant negative correlation between use of internet applications such as email and online forums and loneliness. They also found a significantly positive relationship between internet use and perceived social support.

However, not all studies found a resoundingly positive association between older people's use of ICT and their social involvement and participation. Weaver et al. (2010) found that only a small minority of people used a computer to keep in contact with family; and they often did so reluctantly as it was the only way to remain in contact with their grandchildren. Koopman-Boyden & Reid (2009) found no significant relationships between use of the internet and email and contact with family and other people. Slegers et al. (2008) revealed no significant effects between computer usage and training on the one hand, and loneliness and meeting with friends on the other. And Woodward et al. (2011) found that there were no statistically significant improvements in loneliness amongst participants who took part in an ICT training programme, although baseline loneliness levels were low.

There was also evidence of negative effects from ICT use on social involvement and participation. For instance, Huang's (2010) meta-analysis (was not restricted to studies exclusively of older people) found a negative association between high internet use and well-being. Sum et al. (2008) demonstrated that social loneliness was positively correlated with the amount of time older people spent using the internet.

Thus, there were potentially both positive and negative outcomes for social networking for older people using ICT. At best, it could reinforce existing relationships, but there is no clear evidence of its impact on expanding social networks. For instance, Sayago & Blat (2010) and Bailey and Ngwenyama (2011) found that older people did not use email to make new friends, but rather relied on traditional methods perceived to be "safer". Sum et al. (2008) noted that using the internet to communicate with new people was associated with increased levels of loneliness. On the other hand, Blažun et al (2012) found significantly positive correlations between making new friends and sending emails and attending computer training respectively. The authors also noted a link between level of sociability at baseline and ability to establish new friendships using ICT during the study.

Remote care

The topic of social involvement and participation in relation to ICT-based care services frequently centres on the face-to-face contact between (older) patients and care practitioners. Many studies discussed reluctance amongst older adults to adopt ICT-based care services for fear of losing the "human touch" of traditional care services (Boonstra and van Offenbeek, 2010; Chou et al., 2013; Independent Age, 2010; Lorenzen-huber et al., 2011; Matthews et al., 2010; van Offenbeek and Boonstra, 2010; Sheaves et al., 2011; Walsh and Callan, 2011). Indeed, Milligan et al. (2011) pointed out that some older people deliberately made false alarms to gain social contact with care practitioners.

There is limited quantitative evidence of the effects of ICT-based care on social involvement. Kim et al. (2009) found that face-to-face meetings between (older) patients and care practitioners were improved with use of electronic patient records. However, results were based on a very small sample (n= 11). Brownsell et al. (2008) found a slight improvement in the social functioning of older people using telecare at follow-up compared to baseline, but improvements waned between 6 and 12-month follow-up periods. Damant et al. (2013) found no significant impact of remote alarm and monitoring services on social networking. Although participants tended to perceive the services as helpful in terms of speaking to people and receiving visitors, there was a tendency for participants to find the services unhelpful for reducing loneliness. Garceau et al (2007) reported that one of four participants reported that telecare allowed them to continue receiving visitors to their home and to stay in contact with close friends and family; no participants found the services helpful towards meeting people *outside* of their home.

4.   Occupation

Occupation includes all the many meaningful activities in which people engage, including work, information-seeking, hobbies and pastimes, leisure and entertainment.

Mainstream ICT

There was strong evidence to suggest that using ICT had a positive effect on older people's ability to carry out work, leisure, hobbies and information-seeking activities (Choudrie et al., 2010; Gatto and Tak, 2008; Independent Age, 2010; McMurtrey et al., 2011; Morris et al., 2007; Selwyn, 2004; Slegers et al., 2008).

ICT use has had an impact on the active participation in associations of all kinds including social, religious, political and tenant associations, clubs and organisations. Koopman-Boyden & Reid (2009) noted that older internet users were significantly more likely to take up leadership roles in social and community organisations. Participants were also more significantly likely to use the internet if still employed, compared to those not employed. Harrod (2010) and Mukherjee (2011) presented qualitative findings on use of email and the internet to coordinate volunteering activities. Mason et al. (2012) found a significant association between using the internet and being a member of political, religious, environmental, tenant and resident associations and groups. Cresci et al. (2010) found that older computer users were significantly more likely than non-users to join community organisations and do volunteer work. Weaver et al. (2010) reported that "younger" older participants perceived computers to be useful to occupy their time in the future, when they would be less physically active. Plaza, et al. (2011) discussed the potential for ICT to enable older people to continue pursuing their hobbies at times when they have physical limitations.

Remote care

Only one small study reported on the effects ICT-based care on occupation: Garceau et al. (2007) noted that two out of four participants mentioned that the services had a positive effect on ability to carry out leisure activities.

5.   Psychological wellbeing

Psychological wellbeing includes dignity, self-esteem and self-worth, and positive and negative feelings.

Mainstream ICT

Several qualitative studies described direct positive effects of using ICT on older people's wellbeing. For instance, Sayago & Blat (2010) recounted the enjoyment and sense of purpose experienced when using email to communicate with loved ones. Sayago & Blat (2010), Hill et al. (2008), Gatto & Tak (2008) and Independent Age (2010) also provided data about older people experiencing a "sense of accomplishment", "pride", feelings of empowerment and increased self-esteem from using email and the internet, and taking part in ICT training.

In addition, the *Sus-IT* project (2011) reported that older people felt mentally alert and challenged, and subsequently more youthful as a result of going online (Independent Age, 2010).

The effects of ICT use has also been measured quantitatively. Koopman-Boyden & Reid (2009) reported a significant positive relationship between using the internet and email and overall wellbeing. Woodward et al. (2011) found older people who followed an ICT training programme had significantly higher self-rated QOL compared to those who did not receive training. Tsai et al (2010) reported a significant drop in depressive status for older people in residential care using a video-conferencing service at three-month follow-up. Erickson & Johnson's (2011) correlation analyses suggested a significant positive link between use of the internet and life satisfaction, and a significant negative correlation between internet use and depression. Slegers et al. (2008) found that older people who were interested in - and used - a computer had significantly lower anxiety at baseline than older people who were not interested in using ICT. Finally, Cresci et al. (2010) found significantly higher levels of "senior optimism" in older computer users compared to non-users.

On the other hand, Mason et al. (2012) found only a weak association between anxiety and internet use: older people who experienced anxiety were more likely to be non-internet users. Woodward et al. (2011) found no significant differences in depression between older adults who did or did not participate in ICT training, although their participants started with low depression levels.

Remote care

A few small-sample qualitative studies have explored effects of older people's use of ICT-based care on their sense of dignity. Age UK (2010) and Boonstra & van Offenbeek (2010) reported that telecare users perceived an increase in psychological wellbeing from using services. Matthews et al. (2010), Cardozo & Steinberg (2010), and Walsh & Callan (2011) discussed the reassurance that older people and their carers obtained through using ICT-based care. Sheaves et al. (2011) found that all participants agreed to some degree that the internet increased confidence in dealing with their long-term condition. Brandt et al.'s (2011) review of telecare and smart home technology identified seven studies which considered the impact of the services on self-esteem, happiness, and self-perceived QOL, the results demonstrating that overall, the services had positive effects.

Quantitative studies showed mixed effects with respect to psychological wellbeing. Damant et al. (2013) reported that significantly more participants of the MonAMI trial felt that remote monitoring and alert services were helpful (rather than unhelpful) in enabling them to feel optimistic about their future and reducing anxiety. The *Whole Systems Demonstrator* (WSD) trial reported that both telecare and telehealth services had no significant effect on anxiety or depression symptoms from baseline to 12-month follow-up (Cartwright et al., 2013), but telecare had small, significant effects on reducing the rate of decline of mental health-related quality of life and depressive symptoms, although not on anxiety (Hirani et al., 2014). Chou et al. (2013) suggested that telehealth enabled participants to experience less anxiety about their illness and experience fewer negative feelings more generally, but no tests of significance were reported.

On the other hand, both Brownsell et al. (2008) and Bowes et al. (2009) found no significant effects on mental health scores from using telecare and tele-monitoring services.

Closely related to dignity are feelings associated with the obtrusiveness and subsequent stigmatising effects of using ICT-based care. Zweijsen et al. (2011) broadly defined obtrusiveness of ICT-based care as care which is disruptive or invasive of users' physical space, leading users to feel stigmatised or experience loss of dignity (Age UK, 2010; Karunanithi, 2008). Several sources discussed how some monitoring services and wearable devices implied to older users that they were becoming increasingly frail, disabled and dependent (Ding et al., 2011; Lloyd, 2010; Roberts, 2009; Sixsmith and Sixsmith, 2008; Turgeon-Londei et al., 2009; Wagner et al., 2012; Zweijsen et al., 2011). For instance, Walsh & Callan (2011) and Milligan et al. (2011) reported that older people were reluctant to wear their pendent alarms because they felt stigmatised as needing care and assistance. Williams et al (2010) found that 41% of respondents were "very concerned" or "concerned" about "carrying a device all day". Sanders et al. (2012) found that many people withdrew from the WSD trial because

they associated telecare and telehealth with being dependent and in poor health, and they wanted to distance themselves from negative inferences of old age and illness.

The obtrusiveness of ICT also spurred discussions concerning the disappearing boundaries between the home and institutionalised care (Milligan et al., 2011). Palm (2013) noted that a growing number of older people with care needs lived at home because they used ICT. However, as their needs grew and became more complicated, the "home" space became occupied by more equipment, aids and, indeed, care staff. Milligan et al. (2011) and Sixsmith & Sixsmith (2008) suggested that there is a risk that the home can shift from being an individuals' personal sanctuary to an impersonal place of hurried activity.

6.   Physical capability

Physical capability is the sixth domain of the combined QOL model. In this research, it captures how use of ICT affects individuals' physical abilities to carry out their daily activities. This extends to how ICT services effect individuals' health-related behaviour and knowledge, as well as their awareness of health issues that directly affect physical capabilities.

Mainstream ICT

Very few associations have been found between older people's use of mainstream ICT and their physical capabilities. Taylor (2012) reported that approximately a third of all UK homes have a Wii Fit system at home and argued that this could be considered a form of telehealth if the vital sign data were transmitted to health clinicians. Gatto & Tak (2008) noted that most respondents found information on the internet of little or no help as a resource for diet and exercise. Slegers et al. (2008) found no consistent impact from older people's use of ICT on participation in physically active sports.

We searched for evidence on the extent to which older people used the internet to carry out health information searches, as an indicator of health awareness and knowledge and self-managed care. Several studies indicated that seeking health and medical information was one of the most common uses of ICT amongst the older population (Bailey and Ngwenyama, 2011; Chou et al., 2013; Harrod, 2010; Mason et al., 2012; McMurtrey et al., 2011; Olson et al., 2011; Robertson-Lang et al., 2011).

Gatto & Tak (2008) measured older people's perceptions of the helpfulness of online health information as a means of gaining knowledge about illness, treatments and therapies; approximately 50% of respondents found the Internet helpful. Similarly, Sheaves et al. (2011) found that the majority of their participants were satisfied to some degree with the online information they obtained about their long-term condition.

Aside from the above, the literature on ICT and health information focuses on barriers faced by older people when conducting health-related online searches, such as their level of health and ICT-related literacy and accessibility of websites.

On the other hand, there were observations from several countries concerning how older people's self-rated health correlated with use of mainstream ICT. For instance, Gracia & Herrero (2009) found that older people living in Spain who use the internet had significantly better self-rated health than non-users. In New Zealand, Koopman-Boyden & Reid (2009) found a significant positive relationship between internet and email usage and self-rated health. An American study by Cresci et al. (2010) showed that computer users were significantly healthier than computer non-users. Heart's (2013) Israeli-American study also indicated a major effect of good health on computer use when interacting with age.

Remote care

By design, ICT-based care devices, services and systems compensate to some extent for physical, sensorial and cognitive limitations (Age UK, 2010; Matthews et al., 2010). Moreover, several ICT-based care services provide health-related information or include behaviour-modification applications to assist self-management of illness and care (van den Berg et al., 2012). Williams et al. (2010) found that 56% and 50% of respondents (respectively) rated medicine reminder and vital sign monitoring features of remote care services as "important". However, evidence of the effects of ICT-based care on behaviour, knowledge and control over health issues is limited and at times contradictory.

Van den Berg et al. (2012) and Aalbers et al. (2011) conducted comprehensive systematic reviews of ICT-based home care and internet-mediated interventions respectively. They concluded that there was a trend towards improvement in health-related behaviour such as medication compliance, weight and disease management for older service users, although reported changes were often not significant or were short-term. Bowes (2009) found that telehealth users did not have significantly different medication adherence compared to a control group receiving more face-to-face nurse visits.

Chou et al. (2013) showed that older people felt that they had improved knowledge about, and more control over, their health by using telehealth. Participants highly rated the services in terms of "distraction due to pain". Bowes et al. (2009) also observed significant improvements in medication knowledge amongst users of telehealth services who also received frequent nurse visits.

In terms of self-rated health, Brownsell et al. (2008) and Hirani et al. (2014) reported no significant improvements for older people using telecare over a year. Similarly, Bowes et al. (2009) and Cartwright et al. (2013) did not find significant effects on self-rated health for people using telehealth services. The MonAMI evaluation showed that significantly more participants found the telecare services to be "unhelpful" than "helpful" in terms of feeling energetic, managing their medication and memory. A similar trend was observed for perceptions of the services' lack of helpfulness for managing pain (Damant et al., 2013).

Discussion

Our review suggests that older people's use of ICT brings many benefits to quality of life. In particular, some older people achieve a sense of control and independence over their daily lives, reinforce their social networks, gain a sense of safety, pursue pastimes and other meaningful activities, and improve overall psychological wellbeing.

Yet the benefits were not universal. Findings were especially varied for social involvement and participation, personal safety and security, and psychological wellbeing. For social involvement and participation, while overall the results from qualitative studies suggested that ICT use had positive impacts on family contacts and inter-generational relationships; weak, negative or insignificant effects on loneliness, visiting and general social functioning were most often reported in quantitative studies. In fact, some findings implied that ICT use could negatively affect QOL by exacerbating feelings of loneliness. Therefore, contrary to the assumption that engagement with ICT is essential for older people to remain socially active and to combat loneliness, the evidence could be said to imply that use of ICT positively reinforces existing social networks, but generally has no effect on building new ones.

The analyses for personal safety and security further confirmed that the benefits of ICT use are often uncertain. Several sources claimed that ICT use, in different contexts, improved perceptions of personal safety and security, especially from using a mobile telephone. However these claims are not completely substantiated upon closer investigation of the evidence, as there were several issues around privacy, intrusiveness and data protection that many older people are uncomfortable with, particularly when considering ICT services using the internet and video equipment.

Evidence on psychological wellbeing for ICT use in a care context was similarly mixed. While the overall effects of ICT use on this domain in mainstream contexts are positive, the effects of ICT in care contexts are more negative. This division between mainstream and care-related applications may link to findings regarding physical capability, which suggests a positive association between older people's health state and ICT use. In the same vein, participants in studies of ICT-base care

services have care needs and likely some form of limiting illness or disability that may influence access to, and use of ICT, suggesting that the observed effects of ICT use on psychological wellbeing could reflect a person's state of health or general favourable disposition, rather than the use of ICT itself. This sustains Koopman-Boyden and Reid (2009)'s queries about the direction of causality, where the QOL outcomes associated with technology use may be shrouded by users' baseline conditions for adopting ICT in the first place.

Overall, the mixed findings on effects on QOL lend support to the conclusions of Dickenson (2006), Weaver et al. (2010) and Plaza et al. (2011), who challenged the common assumption that older people's use of ICT enhances quality of life. It would be wrong to assume that there is a technology solution to every social problem, particularly with respect to a generation of older "digital immigrants", for many of whom ICT plays only a tangential role in their daily lives (Dutton and Blank, 2013; Hernandez-Encuentra et al., 2009; Vodanovich et al., 2010).

Implications

The complicated nature of relationships between ICT use and QOL suggests that trade-offs are made: benefits of using ICT in one domain are weighed against disadvantages in another domain (Wright & Wadhwa 2010). Several reports discussed concessions some people are willing to make in terms of privacy and security in order to live independently in their own homes with the use of monitoring services (Blaschke et al., 2009; González-Vega et al., 2011; Matthews et al., 2010; Sixsmith and Sixsmith, 2008; Turgeon-Londei et al., 2009; Wagner et al., 2012; Zweijsen et al., 2011). Gaining a level of independence and sense of security might be achieved at the expense of face-to-face contact with care practitioners. Continuous surveillance and monitoring services which offer security and independence could force older people to sacrifice personal autonomy as they lose the ability to choose when to use services and what personal information is shared with others. Mahoney & Mahoney (2010) commented on the trade-off between the reliability of wearable monitoring services and the stigmatising effects of services for people living with dementia.

In the *Care Act 2014* (Department of Health, 2014), the English Government renewed its commitment to personalised care, and promoted ICT-based care as a way to achieve this aim. However, the evidence analysed here suggests widespread concerns that CT-based care intended to promote independence (and save costs) could inhibit older people's pursuit of human contact and social involvement (Lloyd, 2010), and could have a detrimental effect on overall QOL (Sixsmith and Sixsmith, 2008).

The lack of resoundingly positive evidence also reflects challenges in integrating social outcomes within ICT-based care, as the primary aim of the latter is not to provide human care, but rather to complement existing face-to-face services (Boonstra and van Offenbeek, 2010; Demeris et al., 2009; Independent Age, 2010; Milligan et al., 2011; Sanders et al., 2012). Given that on balance the results on the effects of ICT use on a singular domain of QOL are inconclusive, introducing the concept of trade-offs offers an alternative for understanding QOL in this context. Providing a more balanced and realistic description of the benefits could help ICT service developers and providers to build appropriate support services which would both encourage the uptake of ICT as well as compensate for aspects of QOL compromised by the technology.

Future research

Our findings expose a number of topics around QOL and ICT which need further exploration. Firstly, the combined QOL framework used in our review proved useful in organising evidence. It helped underscore that the evidence on ICT-based care is limited and inconsistent. Van den Berg's (2012) review of ICT-based care services also showed that fewer than a fifth of 68 eligible studies measured QOL. This may be attributable to the difficulties in both defining and isolating the social outcomes which can be addressed by technology, especially given their overlap and interconnectedness (Dickens, 2011).

A limitation of our model lies in its usefulness in detecting the effects of ICT use on physical capabilities. Overall, there was little evidence which corresponded to how the physical capabilities domain was defined in the combined QOL framework. Agree & Freedman (2011) pilot-tested the Assistive Technology Quality of Life Scale, yielding similarly ambiguous results on the role of assistive technologies in reducing pain, fatigue and ability to carry out day-to-day activities. The findings may be attributable to difficulties of directly attributing alleviation of physical symptoms to use of ICT-based devices or services. Results may also be an artefact of sample selection, where the baseline health state of participants is relatively good, causing a ceiling effect. Difficulties with evaluating the relationship between ICT use and physical capabilities also lie with the available body of instrumentation, which is neither adequately sensitive nor specific to assess QOL outcomes.

Secondly, in several cases quantitative measurements of older people's QOL yielded mostly insignificant results highlighting methodological challenges in uncovering causal relationships between technology use and the subjective aspects of QOL Both device use and psychological wellbeing, for instance, are affected by some extraneous factors which cannot be easily isolated or explained using strict research protocols typically associated with quantitative research (Robson, 2011, p. 21). For instance, Hirani et al (2014) suggested the mixed quantitative findings for the effects of using ICT-based care on psychological wellbeing could reflect the complexity of emotions

that many older people experience when managing an illness or long-term need. Therefore unpicking these complex human experiences through exploratory qualitative research may provide better insight into the effects of ICT (Pawson et al., 2005).

Finally, the many older people who do not use ICT are underrepresented in research, making it difficult to ascertain how their QOL and ability to participate in their communities are improved or compromised by not using ICT, as well as to hypothesize how their QOL would change if they used ICT. Indeed, we found evidence that many older people do not participate in ICT-based leisure and diversion activities or use social networking sites (Choudrie et al., 2010; McMurtrey et al., 2011; Plaza et al., 2011; Weaver et al., 2010), although these are older studies and the context is changing rapidly. There is a need for a concerted effort to include older <u>non</u>-users in empirical research and to investigate their QOL within the context of the digital society.

Limitations

Our review has limitations. Overall, scoping reviews are more inclusive than systematic reviews, both in terms of sources of information searched, and in terms of the range of research methods used to garner the evidence. Therefore, in comparison to studies included in a systematic review, there will be more variability in the "quality" of studies included a scoping review, especially when using hierarchal quality frameworks which often have a quantitative bias. Also, given range and complexity of the topics around older people's use of ICT and QOL, the scope of our review was broad and the investigation of the related subtopics may be less comprehensive than with a more focused review.

Taking a pragmatic approach to literature reviewing also highlighted the diversity in how each main issue of this study is defined. For instance, "older age" was defined very differently across studies, the meaning of ICT similarly varied a lot, and as discussed QOL also have many meanings. To understand the context of ICT use and QOL, the parameters of this research were defined broadly.

Finally, there is always delay in evidence appearing in the peer-reviewed literature. Given the fast-moving nature of digital technologies, published results may not fully reflect current reality. In particular, many adults today contemplating moving into the 'older age' category rely much more extensively on ICT in their daily lives than do today's older people; their experiences and expectations of a "digital society" in old age will likely differ considerably.

Conclusion

Overall, the evidence suggests that older people's ICT use has both positive and negative effects on quality of life; and when they "trade-off" the constructive and obstructive aspects of technology, it can facilitate their participation in social networks and communities. However, the topic of older

people's engagement with the digital society remains largely under-researched; in particular, more attention should be given to development of appropriate research instruments and inclusion of older *non*-users.

Source of Funding:

Tables, figures, boxes

Table 1 Search Strategy

Table 2 ASCOT domains

Table 3 WHOQOL domains

Table 4 Description of the combined ASCOT and WHOQOL model

Table 5 Summary of evidence on the effects of ICT use for mainstream and remote care purposes on six domains of QOL

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