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Exploring factors influencing willingness of older adults to use assistive technologies: evidence from the cognitive function and ageing study II

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ABSTRACT

Technology is widely promoted as a solution to greater independence and better health for the rapidly growing UK older population. If this is to be realised, we need to understand barriers and facilitators to uptake and investigate who wants this technology and who does not express an interest in use. This analysis is based on data from a population-based cohort study, the Cognitive Function and Ageing Study (CFAS)-II, which focused on brain health in older people and included questions about access to- and interest in- internet technologies. The factors affecting willingness to use technologies that support memory and ADL were identified using binary logistic regression analysis. 541 people aged 75 years and older from Cambridgeshire, Nottingham and Newcastle responded. Older adults were more willing to use technologies directed towards improving memory (65%) than towards ADL supportive technologies (38%). Regression analysis showed that an older age (OR = 0.64, 95% CI = 0.34–0.98), female gender (OR = 0.64, 95% CI = 0.42–0.99), no access to technology including laptops and tablets (OR = 0.48, 95% CI = 0.32–0.72), and self-reported physically less slowing down (but no objective health indicators) (OR = 0.57, 95% CI = 0.36–0.88) were strongly associated with UK older adults' lesser willingness to use memory assistive technologies while not having access to laptops and tablets (OR = 0.57, 95% CI = 0.39–0.84) was associated with willingness to use ADL supportive technologies. Older people, females and those with less access to technologies should be considered as target groups by healthcare providers, policymakers, and technology producers to promote technology and support healthy and independent ageing.

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Background

The world population is ageing as a consequence of increasing life expectancy (Harper, 2015). In the UK, nearly one in five people is currently over 65, which proportion is expected to rise to one in every four people by 2050 (ONS, 2019). Ageing is accompanied by a higher prevalence of chronic diseases, which can cause physical, cognitive, and psychological limitations, negatively affecting levels of independence and quality of life (Kulik et al., 2014). This increased dependency is also associated with a significant increase in healthcare costs (Mirko & Michal, 2018). Emerging and assistive technologies, including but not limited to information and communication technologies (ICT), assistive robots and supportive technologies such as hearing aids, eyeglasses, mobility aids and communication aids are promoted as potentially maintaining health and independence for older adults and are being designed and developed to reduce the high cost of institutionalised care (Puri et al., 2017; Van Hoof et al., 2011). Technology may also support older people to participate more in meaningful community and individual-based activities and help provide an improved sense of safety, reassurance, and communication (Wang et al., 2019). Recent research has indicated that various technologies can also be used in numerous ways for assessment, monitoring, and maintenance of function, caregiving, and leisure activities (Andrews et al., 2019).

Although older adults are increasingly interested in such technologies (29% in 2013 vs., 54% in 2020), the acceptance, adoption and usability of technology are lower compared with the younger population (54% in over 75s and 99% in 16–44, respectively) (ONS, 2020; Quan-Haase et al., 2018). Older adults in general lag behind in engagement with new technology and the development of necessary skills. This may be because some older people do not see the presumed benefit of technology, while others have perhaps had limited experience and interaction with innovative design in general (Fischer et al., 2014). New assistive technology might therefore be less desired by older people, especially those with cognitive, mood, and physical dysfunction, and this could be further affected or modified by demographic variables, such as age, gender, marital status, ethnicity, deprivation, and education (Wallcook et al., 2021). Compared with young people, older people also have more heterogeneous educational levels, socio-economic status, and physical health conditions, which make the factors affecting their willingness to use technology more complex (Guner & Acarturk, 2020). Therefore, understanding the main driving factors affecting the willingness of older people to use supportive technologies can reveal target groups to better focus on for policymakers, technology manufacturers and public health companies. This could help older adults possibly to become more open to the potential possibilities and benefits of these technologies.

Previous studies have focused on older adults' attitudes and acceptances of technologies (Guner & Acarturk, 2020; Mitzner et al., 2019), but few studies have examined which factors affect older adults' willingness to use technology – a concept separate from attitudes and referring to a person's intention to use a particular technology under specific circumstances (Hassan et al., 2021; Kadylak & Cotten, 2020). Although some studies have investigated this in different countries (Jo et al., 2021; Kadylak & Cotten, 2020), to the best of our knowledge, there has been no study investigating this within older people in the UK. Moreover, while many studies focus on sociodemographic and technology-related factors (Wang et al., 2021; Yap et al., 2022), studies investigating how physical visuomotor and general health and ability could play a role in this relationship are limited (Chen & Chan, 2014).

Research is therefore needed to explore the willingness of older adults of different demographics in the UK to use assistive technologies and assess whether physical health plays a role in it. This might increase the uptake of these technologies by identifying factors to better target people and, identify systematic bias in uptake. The aim of the study is to understand the factors influencing the willingness of older adults in the UK to use new technologies which offer potential health and independence opportunities.

Research questions

- RQ1. What factors (socio-demographic-, health-, and independence status) predict the willingness of older adults in the UK to use technologies which promote keeping mentally, physically and socially active to promote memory and well-being?
- RQ2. What factors (socio-demographic-, health-, and independence status) predict the willingness of older adults in the UK to use technologies which help to keep them safe, support activities of daily living such as reminding them of appointments?

Methods

Study design

The present study used data collected in the Cognitive Function and Aging Study (CFAS)-II, which is a large multi-centred, population-based study. Details of the CFAS-II study design have been described in a previous paper (Matthews et al., 2013). In brief, older people (≥ 65) from three different geographical regions of England (Cambridgeshire, Newcastle, and Nottingham) were recruited in the CFAS-II study. The participants were randomly selected from the general practitioner list and their physical, mental, and cognitive functions were assessed, as well as their socio-demographic characteristics, by a trained researcher using a detailed questionnaire. The present study used the data from the third wave follow-up conducted in 2018 and 2019. The interests of 541 participants in using assistive technologies were investigated using the two specific questions set out below. Ethical approval for the study was sought and given by the Wales Research Ethics Committee (18/WA/0120). The trial was registered in the ISRCTN database (ISRCTN 14643514).

Measures

Dependent variables

The two questions, which measured the participants' willingness to use the technology using binary response options (1 = yes, 0 = no) were used as dependent variables. The first question explored attitudes to technologies which promote a more active life by improving memory whereas the technologies in the second question were about those supporting everyday activities and safety:

Q1. If there was a technology which promotes keeping mentally, physically, and socially active, and which was shown to improve memory and well-being, would you be interested in having it in your home? (ICT-mem)

O2. If there was a technology which helped to keep you safe and remind you of appointments, when to take your medication etc., would you be interested in having this in your home? (ICT-ADL)

Independent variables

The socio-demographic factors included age, gender, socio-economic status, type of accommodation, and education status. Socio-economic status (SES) was used for socio-economic classification and categorised into seven groups depending on the occupations of the participants: (1) higher managerial, administrative and professional; (2) lower managerial, administrative and professional; (3) intermediate occupations; (4) small employers and own-account workers; (5) lower supervisory and technical occupations; (6) routine or semi-routine occupations; and (7) never worked or long-term unemployed (Cognitive Function and Ageing Study, 2015; Rose et al., 2005). Relationship status was categorised as either (1) married (married, civil partnership or cohabitating) or (2) single (single, widowed or divorced/separated). Housing was also divided into two types; (1) independent or (2) assisted housing. Education status was categorised into three groups according to how many years the participants had spent in full-time education: (0–9 years) 'basic-', (10–11 years) 'moderate-' and (≥12 years) 'high' educational attainment (Cosco et al., 2017). Whether the participants had access to technology (laptop/tablet or smartphones) and their confidence in using these technologies (sending and receiving emails) were captured with yes/no questions. Ethnicity had been included, but as the vast majority of the sample (98.9%) was white English, this variable was excluded from further analyses.

Physical function can be related to independence and the following factors were included in this study (Fried et al., 2001). Self-reported physically slowing down was assessed with a single question and categorised into three groups; (0) 'no difference', (1) 'mildly slowed down' and (2) 'severely slowed down' (Cognitive Function and Ageing Study, 2015). The number of accompanying self-reported chronic diseases (having been diagnosed with stroke, heart attack, high blood pressure, low blood pressure, diabetes, head injury, high cholesterol etc.) was classified as 'no comorbidity', 'single comorbidity' and 'multiple comorbidities' (Matthews et al., 2016). Balance and fall risk were assessed using the 5-Chair Stand Test (5-CST) and categorised as 'fast' (time taken to complete less than 12s), 'moderate' (12–15s), 'slow' (greater than 15s) and 'unable to complete the test' (Dodds et al., 2021). Individuals were also asked to walk along a 2.4 m level surface to measure their gait speed. Walking speed determined according to the ratio of the test completion time to the distance was categorised as 'fast' (≥1 m/s), 'moderate' (>0.8 and <1 m/s) or 'slow' (≤0.8 m/s) (Cruz-Jentoft et al., 2019; Dodds et al., 2021). Disability level was measured using the Modified Townsend Disability Scale. The result of this scale, which includes nine activities, ranges from 0 to 18 classified into five groups: (0) 'no incapacity', (1–2) 'slight incapacity', (3–6) 'some incapacity', (7–10) 'appreciable incapacity' and (≥11) 'severe incapacity' (Melzer et al., 2000). Activities of daily living (ADL) and instrumental activities of daily living (IADL) disabilities were classified into three groups depending on questions related to daily activities (see CFAS-II data information): (0) ADL-IADL impairment, (1) IADL impairment and (2) no ADL-IADL impairment (Cognitive Function and Ageing Study, 2015; Katz, 1983; Lawton & Brody, 1969). The

Cambridge Cognitive Examination perception subscale was used for visual perception (Roth et al., 1986). This scale contains eight pictures and ranges from 0 to 8 according to the number of pictures correctly recognised. Self-reported eyesight and hearing problems were asked through yes/no questions asking the respondents if they suffer from hearing or vision problems which interfere with everyday activities.

Statistical analysis

Participants' response frequencies and means (SD) were reported for each variable. Using descriptive statistics (non-parametric Mann Whitney-U, independent t-test for normally distributed variables, or Chi-square test for percentages), the characteristics of those who were willing to use the technology and those who did not were compared. Spearman's rank correlation analysis was performed to determine which independent variables were statistically significantly related to the dependent variables, with a significance level set at $p < 0.05$ (2-tailed). Binary logistic regression analysis (with the 95% Confidence Interval or CI) investigated the characteristics of those who were willing to use which technology vs. those who did not. This analysis, which included only the variables which were significantly correlated with the dependent variables, was performed using the backward-elimination method. The backward approach was used in order to identify the most important variables for predicting the outcome variable. Variables were excluded based on a significance level of $p > 0.05$. The models were evaluated using the Nagelkerke R2 value and the Hosmer and Lemeshow goodness-of-fit test. All statistical analyses were performed using IBM SPSS 27 statistical software. The significance level was set to alpha = 0.05, 2-tailed for all analyses.

Results

The characteristics of the participants and the comparison of these characteristics according to their willingness to use the technologies are given in Table 1. In this study, which included the data of 541 participants in total, most of the participants (65%) were willing to use technologies that would keep them physically, mentally, and socially active to improve memory and well-being. In contrast, most (62%) were not willing to use technologies which aided their ADL (see Table 1). For both types of technologies, the average age of respondents who were interested in using the technology (80.9 and 80.8, respectively) was slightly lower than that of those who were not (81.9 and 81.6, respectively). Slightly more men were willing (55%) than women (45%) to use technologies which would keep them active and improve their memory. However, the descriptive statistics showed that there was no significant difference in gender ratios to want technology to aid ADL. In terms of technology to aid memory, there was a significant decrease in the proportion of technology interest from upper SES to lower SES, whilst there was no significant difference between social classes in use of ADL supportive technology (see Table 1). Similarly, those in the higher educated group were significantly more willing to use memory aiding technology. Participants in a relationship were more willing to use both types of technological devices (ICT-mem: 70% and ICT-ADL: 42%, respectively) than single participants (ICT-mem: 59% and ICT-ADL: 33%, respectively). There was no significant difference in willingness to use technology by

Table 1. Participant numbers with sample percentages and means with standard deviations (SD) by health and covariate variables.

Variables	All participants (n = 541)	ICT-mem yes (n = 351)	ICT-mem no (n = 190)	*P* value	ICT-ADL yes (n = 205)	ICT-ADL no (n = 336)	*P* value
Age (years), mean (SD)	81.3 (4.2)	80.9(4.1)	81.9 (4.3)	$P = 0.01$*	80.8 (3.9)	81.6 (4.3)	$P = 0.04$*
n (%)	226 (42%)	164 (72%)	62 (28%)	$P = 0.01$*	96 (43%)	130 (57%)	$P = 0.11$
75–79	184 (34%)	111(60%)	73 (40%)		68 (37%)	116 (63%)	
80–84	131 (24%)	76 (58%)	55 (42%)		41 (31%)	90 (69%)	
≥85							
Gender, n (%)	262 (48%)	157 (45%)	105 (55%)	$P = 0.02$*	171 (51%)	91 (44%)	$P = 0.1$
Female	279 (52%)	194 (55%)	85 (45%)		165 (49%)	114 (56%)	
Male							
Socio-economic Status, n (%)				$P = 0.01$*			$P = 0.2$
Higher managerial, administrative and professional	42 (8%)	32 (76%)	10 (24%)		22 (52%)	20 (48%)	
Lower managerial, administrative and professional	259 (49%)	180 (70%)	79 (30%)		98 (38%)	161 (62%)	
Intermediate occupations	6 (1%)	3 (50%)	3 (50%)		2 (33%)	4 (67%)	
Small employers and own-account workers	86 (16%)	48 (56%)	38 (44%)		27 (31%)	59 (69%)	
Lower supervisory and technical occupations	58 (11%)	27 (47%)	31 (53%)		18 (31%)	40 (69%)	
Routine or Semi-routine occupations	55 (10%)	40 (73%)	15 (27%)		26 (47%)	29 (53%)	
Never worked and long-term unemployed	21 (4%)	13 (62%)	8 (38%)		8 (38%)	13 (62%)	
Marital Status, n (%)				$P = 0.01$*			$P = 0.03$*
Married	305 (56%)	212 (70%)	93 (30%)		128 (42%)	177 (58%)	
Single	256 (44%)	139 (59%)	97 (41%)		77 (33%)	159 (67%)	
Housing, n (%)				$P = 0.77$			$P = 0.37$
Independent	520 (96%)	338 (65%)	182 (35%)		199 (38%)	321 (62%)	
Adopted	21 (4%)	13 (62%)	8 (38%)		6 (29%)	15 (71%)	
Education level, n (%)				$P = 0.01$*			$P = 0.98$
Basic educational attainment	63 (12%)	32 (51%)	31 (49%)	$P < 0.05$	24 (28%)	39 (62%)	$P = 0.92$
Moderate educational attainment	318 (59%)	204 (64%)	114 (36%)		119 (37%)	199 (63%)	
High educational attainment	159 (29%)	114 (72%)	45 (28%)		61 (38%)	98 (62%)	
Total number of years in any education, mean (SD)	11.3 (2.6)	11.5 (2.5)	10.9 (2.5)		11.2 (2.3)	11.3 (2.7)	
Accessing laptop/tablet, n (%)	334 (62%)	245 (73%)	89 (27%)	$P < 0.001$**	144 (43%)	190 (57%)	$P = 0.001$**
Yes	207 (38%)	106 (51%)	101 (49%)		61 (30%)	146 (70%)	
No							
Accessing Smartphone, n (%)				$P < 0.001$**			$P = 0.01$*
Yes	151 (28%)	115 (76%)	36 (24%)		70 (46%)	81 (54%)	
No	390 (72%)	236 (61%)	154 (39%)		135 (34%)	255 (66%)	
Confidence in sending/receiving email, n (%)				$P < 0.001$**			$P = 0.45$
Yes	229 (42%)	167 (72%)	62 (27%)		91 (40%)	138 (60%)	
No	312 (58%)	184 (59%)	128 (41%)		114 (36%)	198 (64%)	
Physically slowing down, n (%)				$P = 0.01$*			$P = 0.39$
No	31 (6%)	14 (45%)	17 (55%)		9 (29%)	22 (71%)	

Mildly slowed down	345 (64%)	218 (63%)	127 (37%)		128 (37%)	217 (63%)	
Severely slowed down	163 (30%)	118 (72%)	45 (28%)		67 (41%)	96 (59%)	
5-CST, n (%)	82 (15%)	50 (61%)	32 (39%)	*P* = 0.77	27 (33%)	55 (67%)	*P* = 0.66
Fast	99 (18%)	63 (63%)	36 (37%)		36 (37%)	63 (63%)	
Moderate	181 (34%)	122 (67%)	59 (33%)		69 (38%)	112 (62%)	
Slow	179 (33%)	116 (65%)	63 (35%)		73 (41%)	106 (59%)	
Unable							
Gait speed, n (%)				*P* = 0.55			*P* = 0.69
Fast	450 (84%)	287 (64%)	163 (36%)		168 (37%)	282 (63%)	
Moderate	58 (11%)	41 (71%)	17 (29%)		25 (43%)	33 (57%)	
Slow	28 (5%)	19 (68%)	9 (32%)		11 (39%)	17 (61%)	
Disability, n (%)				*P* = 0.57			*P* = 0.35
No incapacity	2 (1%)	1 (50%)	1 (50%)		0	2 (100%)	
Slight incapacity	10 (2%)	4 (40%)	6 (60%)		5 (50%)	5 (50%)	
Some incapacity	52 (10%)	34 (65%)	18 (35%)		24 (46%)	28 (54%)	
Appreciable incapacity	80 (15%)	52 (65%)	28 (35%)		26 (33%)	54 (67%)	
Severe incapacity	371 (72%)	242 (65%)	129 (35%)		137 (37%)	234 (63%)	
ADL/IADL, n (%)				*P* = 0.67			*P* = 0.47
ADL-IADL impairment	85 (16%)	52 (61%)	33 (39%)		37 (44%)	48 (56%)	
IADL impairment	157 (30%)	105 (67%)	52 (33%)		56 (36%)	101 (64%)	
No impairment	290 (55%)	187 (65%)	103 (35%)		108 (37%)	182 (63%)	
Comorbidity, n (%)				*P* = 0.59			*P* = 0.79
No comorbidity	67 (12%)	41 (61%)	26 (39%)		24 (36%)	43 (64%)	
Single comorbidity	262 (49%)	175 (67%)	87 (33%)		102 (39%)	160 (61%)	
Multiple comorbidities	207 (39%)	131 (63%)	76 (37%)		75 (36%)	132 (64%)	
Physical Activity, n (%)				*P* = 0.84			*P* = 0.36
Totally sedentary	87 (17%)	53 (61%)	34 (39%)		35 (40%)	52 (60%)	
Low PA	132 (26%)	86 (65%)	46 (35%)		57 (43%)	75 (57%)	
Moderate PA	204 (41%)	135 (66%)	69 (34%)		69 (34%)	135 (66%)	
High PA	81 (16%)	51 (63%)	30 (75%)		31 (38%)	50 (62%)	
BMI, n (%)				*P* = 0.66			*P* = 0.09
Underweight	2 (1%)	2 (100%)	0		2 (100%)	0	
Normal	101 (20%)	66 (65%)	35 (35%)		30 (30%)	71 (70%)	
Overweight	220 (43%)	148 (67%)	72 (33%)		88 (40%)	132 (60%)	
	118 (23%)	72 (61%)	46 (39%)		42 (36%)	76 (64%)	

(*Continued*)

Table 1. Continued.

Variables	All participants (n = 541)	ICT-mem yes (n = 351)	ICT-mem no (n = 190)	*P* value	ICT-ADL yes (n = 205)	ICT-ADL no (n = 336)	*P* value
Obese	61 (12%)	40 (65%)	21 (35%)		27 (44%)	34 (56%)	
Extremely obese							
Visual Perception, Mean (SD)				*P* = 0.001**			*P* = 0.02*
	6.6 (1.3)	6.8 (1.2)	6.4 (1.4)		6.8 (1.2)	6.5 (1.3)	
Self-reported eyesight problem, n (%)				*P* = 0.85			*P* = 0.85
Yes	114 (21%)	73 (64%)	41 (36%)		42 (37%)	72 (63%)	
No	423 (79%)	275 (65%)	148 (35%)		160 (38%)	263 (62%)	
Self-reported hearing problem, n (%)				*P* = 0.23			*P* = 0.51
Yes	209 (39%)	129 (62%)	80 (38%)		75 (36%)	134 (56%)	
No	328 (61%)	219 (67%)	109 (33%)		127 (39%)	201 (61%)	

*$P < 0.05$, **$P < 0.01$.

type of housing. Descriptive analysis results showed that participants who had access to technological devices such as laptops, tablets, and smartphones were significantly more willing to use technology to aid memory and ADL. Likewise, those who were confident in using technology, such as sending/receiving mail were more willing to use ICT memory supportive technologies, but there was no significant difference in ICT ADL supportive technologies.

As can be seen from the descriptive results, only physical slowdown and visual perception from the health-related factors were associated with interest in technology (see Table 1). Those who were mildly or severely slowed down were more willing to use technological devices which would keep them physically, mentally, and socially active, but this was not seen for ADL. On the other hand, those with better visual perception were also significantly more willing to use the two types of technological devices.

Spearman's correlation analysis showed that age, marital status, access to laptop/tablet, access to smartphones, confidence in sending/receiving email, and visual perception were very weakly related to both ICT-mem and ICT-ADL, whereas ICT-mem was additionally correlated with gender, SES, education, and slowing down. The Spearman's rank correlation matrix, which shows the relationships of all variables with each other, is provided as supplementary material. In this matrix, red shading indicates a negative correlation, whereas blue shading indicates a positive correlation. In addition, the matrix of interrelationships between variables is shown in Figure 1. The figure shows how socio-demographic-related, technology-related, and health-related factors were correlated with participants' willingness to use technology. It is created using an online software, Lucidchart (Faulkner & Contributor, 2018).

Logistic regression results are shown in Tables 2 and 3. Four blocks were created for ICT-mem. Only demographic variables (age and gender) were included in the first block, which explained 3.6% of the variance (see Table 2). Both age and gender were significant and independent contributing factors in this model. In the second block, socio-demographic factors (SES, marital status and education) were added to the model. Age, gender

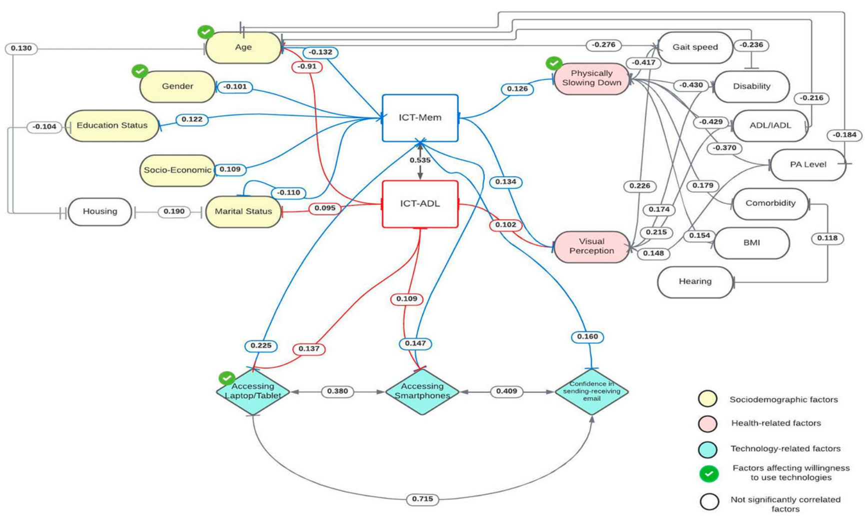

Figure 1. Correlation map showing factors related to willingness to use assistive technology.

Table 2. Logistic regression model for willingness to use technology to aid memory (CI = 95%).

Variables	B (SE)	Wald χ^2 (df)	*P* value	OR (95% CI)
Block 1: Demographic (R^2 = .04; χ^2 = 13.6; $P < 0.01$)				
Age (ref. = 75–79)	-	8.60 (2)	$P = 0.01$	-
Gender (ref. = male)	−0.42	4.96 (1)	$P = 0.03$	0.65 (0.45–
	(0.19)			0.95)
Block 2: Sociodemographic (R^2 = .09; χ^2 = 33.1; $P < 0.001$)				
Age (ref. = 75–79)	-	9.40 (2)	$P = 0.01$*	-
Gender (ref. = male)	−0.49	5.45 (1)	$P = 0.02$*	0.61 (0.40–
Socio-Economic Status (ref. = higher managerial and	(0.21)	19.21 (6)	$P < 0.01$*	0.92)
professional)	-	1.71 (1)	$P = 0.19$	-
Marital status (ref. = married) #	−0.27	1.34 (2)	$P = 0.51$	0.76 (0.51–
Education Status (ref. = basic educational attainment) #	(0.21)			1.15)
	-			-
Block 3: Sociodemographic + Accessing ICTs (R^2 = .12; χ^2	-	5.96 (2)	$P = 0.05$	-
= 45.6; $P < 0.001$)	−0.42	3.82 (1)	$P = 0.05$	0.65 (0.43–
Age (ref. = 75–79)	(0.21)	10.65 (6)	$P = 0.10$	1.00)
Gender (ref. = male)	-	12.51 (1)	$P <$	-
Socio-Economic Groups (ref. = higher managerial and	−0.73	0.32 (1)	0.001**	0.48 (0.32–
professional)	(0.21)	1.29 (1)	$P = 0.57$	0.72)
Accessing Laptop/tablet (ref. = yes)	−0.14		$P = 0.26$	0.86 (0.53–
Accessing Smartphones (ref. = yes) #	(0.25)			1.41)
Confidence in Sending/Receiving emails (ref. = no confident) #	−0.93			0.39 (0.80–
	(0.82)			1.95)
Block 4: Sociodemographic + Accessing ICTs + Physical	-	8.45 (2)	$P = 0.02$*	-
Health (R^2 = .15; χ^2 = 59.3; $P < 0.001$)	−0.64	7.64 (1)	$P < 0.01$*	0.52 (0.33–
Age (ref. = 75–79)	(0.23)	4.31 (1)	$P = 0.04$*	0.83)
Age (80–84)	−0.55	5.45 (1)	$P = 0.02$*	0.58 (0.34–
Age (>85)	(0.26)	11.11 (6)	$P = 0.08$	0.98)
Gender (ref. = male)	−0.49	12.34 (1)	$P <$	0.61 (0.40–
Socio-Economic Groups (ref. = higher managerial and	(0.21)	13.17 (2)	0.001**	0.92)
professional)	-	11.44 (1)	$P =$	-
Accessing Laptop/tablet (ref. = yes)	−0.73	6.23 (1)	0.001**	0.48 (0.32–
Physically slowing down (ref. = severely slowed down)	(0.21)	2.45 (1)	$P =$	0.72)
Physically slowing down (mildly slowed down)	-		0.001**	-
Physically slowing down (no)	−1.53		$P = 0.01$*	0.22 (0.09–
Visual Perception#	(0.45)		$P = 0.12$	0.52)
	−0.566			0.57 (0.36–
	(0.23)			0.88)
	0.12 (0.08)			1.13 (0.96–
				1.31)

#Variable removed from the model.
*$P < 0.05$; **$P < 0.01$.

and SES remained significant factors, whilst others were removed. Technology-related factors (accessing laptop/tablet and smartphones and confidence in receiving/sending emails) were added in block 3, which increased the explained variance and rendered the variables that had been entered in block 2 non-significant. In block 3, only having access to laptop/tablet was a significant factor. In the fourth block, health-related variables (physically slowing down and visual perception) were added. Regarding RQ1, the final model showed that only age, gender, access to laptop/tablet, and reported physically slowing down were significant factors in wanting to use the memory assistive technology in older adults. People in the older groups (80–84 yrs and >85 yrs) were half as likely to want to use technology (OR = 0.52, 95% CI 0.33–0.83, and OR = 0.58, 95% CI 0.34–0.98) than the reference group of 75–79 years old. Women were 39% less likely to want to use technology to aid their memory (OR = 0.61, 95% CI 0.40–0.92). People without access to

Table 3. Logistic regression model for willingness to use technology to aid ADL (CI = 95%).

Variables	B (SE)	Wald $\chi2$ (df)	*P-value*	OR (95% CI)
Block 1: Sociodemographic (R2 = .019; $\chi2$ = 5.60; *P* = 0.018)	-	1.96 (2)	*P* = 0.37	-
Age (ref. = 75–79)[#]	−0.43	5.54 (1)	*P* = 0.02*	0.65 (0.45–0.93)
Marital status (ref. = married)	(0.18)			
Block 2: Sociodemographic + Accessing ICTs (R2 = .035; $\chi2$ = 13.948; *P* = 0.001)	−0.32	2.96 (1)	*P* = 0.09	0.72 (0.50–1.04)
Marital status (ref. = married)	(0.19)	8.17 (1)	*P* < 0.01**	0.57 (0.39–0.84)
Accessing Laptop/tablet (ref. = yes)	−0.56	1.98 (1)	*P* = 0.16	0.74 (0.48–1.12)
Accessing Smartphones (ref. = yes)[#]	(0.20)			
	−0.30			
	(0.21)			
Block 3: Sociodemographic + Accessing ICTs + Physical Health (R2 = .035; $\chi2$ = 13.94; *P* = 0.001)	−0.32	2.96 (1)	*P* = 0.09	0.72 (0.50–1.04)
Marital status (ref. = married)	(0.19)	8.17 (1)	*P* < 0.01*	0.57 (0.39–0.84)
Accessing Laptop/tablet (ref. = yes)	−0.56	2.09 (1)	*P* = 0.15	1.12 (0.96–1.28)
Visual Perception[#]	(0.20)			
	0.11			
	(0.07)			

[#]Variable removed from the model.
**P* < 0.05, ***P* < 0.01.

a laptop or tablet were less than half as likely to be interested in using technology than those with a laptop or tablet (OR = 0.48, 95% CI 0.32–0.72). Likewise, those who reported to be physically not slowed down and mildly slowed down were 43% less likely to want to use technology than those who reported to be severely slowed down (OR = 0.57, 95% CI 0.36–0.88 and OR = 0.22, 95% CI 0.09–0.52).

Similarly, a three-block regression analysis was conducted for ICT-ADL (see Table 3). The analysis initially included socio-demographic factors; age and marital status. When age was removed from the block, marital status had a statistically significant association with a willingness to use technological devices which keep people safe. In the second block, technology-related factors were added. When access to a smartphone was removed from the block, marital status became non-significant statistically and only access to a laptop/tablet remained a significant factor in this model. Finally, block 3 was completed by adding visual perception, the only health-related variable which was statistically significantly related to ICT-ADL. However, visual perception was removed, and it did not contribute to the final model. As for RQ2, our findings suggest that only no access to technologies, including laptops and tablets, was strongly associated with a lower likelihood (OR = 0.57, 95% CI = 0.39–0.84) of being willing to use ADL assistive technologies.

Discussion

We investigated the willingness of older UK-based individuals to use technological devices that have been promoted as being able to keep them active and safe, and the relationship of this willingness with contextual factors. The results showed that being in an older age group, being a woman, having less access to- and experience with- ICT, and self-report of less slowing down physically were independent factors associated with levels of willingness to use supportive technologies.

Major limitations of this study are firstly its relatively small sample size. While collecting data from three different regions with very different demographics reflecting the UK population improves the generalisability of results, the inclusion of only UK older mainly white adults in the study made investigation of ethnic-cultural variability of willingness to use technology not possible. Second, it is possible that people who did not want this type of technology may have been less likely to answer the questions. The two questions asked were also perhaps not clear enough to capture whether the participants also wanted to use the technology. Limited knowledge of technology and the lack of sufficient knowledge of existing technology types could have affected the answers. Therefore, questions in which technologies are categorised and described in detail could have yielded more valid answers. The use of a dichotomous outcome variable to measure willingness to use technology in this study may also have some limitations. While the variable may provide insight into the general level of willingness, it may not capture the nuances and complexities of the construct, such as the extent and context in which individuals are willing to use technology. Further research using more nuanced measures of willingness may provide a more comprehensive understanding of this construct. Finally, some of the participants used assistive devices during the evaluation of sensory functions, such as vision and hearing, which perhaps limited strong correlations between these factors and willingness to use technology. However. the missing data rate of the variables in the dataset was below 5%,[1] which was not at a level that would affect the internal validity of the results (Hardy et al., 2009). In addition, previously published studies in this area found similar results. For instance, the younger-old age group (75–80 yrs) was significantly more willing to use such technologies in our study (see Figure 1). Two systematic reviews also showed that relatively younger old age-groups (60–70) were more willing to use technologies (Wang et al., 2021; Yap et al., 2022). In contrast, Kadylak and Cotten (2020) found that age was not a significant factor affecting the intention to use emerging technologies in older adults (>65). However, since the results of this study only reported the age range of 65–85, they did not reflect individuals aged 85 and above, as included in our study who were less likely to want to use the technology. Likewise, a study involving 300 Korean older individuals reported that the willingness of older people to use home-based healthcare ICTs was not significantly affected by age, which might be due to the categorisation of age range (65–75 and >75), insufficiently capturing the very old (>80) (Jo et al., 2021). With time, more older people are expected to engage with ICT, and this has been a continued and growing trend, with 20% of over 65s using smartphones in 2013, while 65% had access to a smartphone in 2020 (Ofcom, 2020). In our study and others, age was also statistically significantly associated with health and technology-related factors (see Figure 1), (see also; Chen & Chan, 2014; Morrison, 2008). In other studies, ageing was associated with a decrease in walking speed, balance ability, and visual perception, which all negatively affected ADL (Osoba et al., 2019; Song, 2015) and which could have mediated the non-significant objectively verified factors in this study, including lower visual perception in the final models.

Our study showed that men are more willing than women to use technologies to support their mental health. In a study conducted by Sitar-Taut et al. (2018), older men (>65) were more willing to use smart home technologies to support their health. Although the effect of gender in using technologies varies according to different types and benefits of those devices (Kadylak & Cotten, 2020), it has been shown in previous studies that older women (>60) have higher levels of technophobia than men (Hogan, 2006; Wang et al., 2021).

Another factor which significantly affected older people's willingness to use technology is whether they had access to internet-connected technological devices, such as laptops/tablets, which can be explained by the fact that access to such devices is strongly correlated with confidence in using the technologies. Previous studies have shown that access to technological devices and obtaining knowledge about their benefits significantly affect older people's willingness to use technologies which support their health and well-being (Wang et al., 2021; Wang et al., 2019; Yap et al., 2022). Making it easier for older people to access technologies and gain knowledge about them can be an effective way to increase their confidence and willingness to use technologies, which could broaden the use of technology (Lee & Coughlin, 2015). Research has shown that older people benefit from peers to exchange knowledge on ICT, and this could increase technology usage (Fondevila Gascon et al., 2015; Shang et al., 2020). Using libraries with peers aiding access to this technology may be a good solution.

The findings of our study showed, as expected, that physically slower people are more likely to want to use technologies which keep them active. Physical activity, walking speed, balance, disability level, and ADL/IADL are all significantly correlated with physically slowing down, indicating that those factors might have had an indirect effect in our study. Although older people who reported that their physical function is affected by slowing down were more willing to use technology, we found that objectively assessed physical function did not significantly affect willingness to use technology in our study. The results were consistent with the results of previous studies. Chen and Chan (2014) reported that physical function was not a significant factor for willingness to use technology in older people, whereas Kadylak and Cotten (2020) reported that of the six emerging technology types, only the willingness to use an autonomous vehicle and assistive robots was significantly affected by IADL impairment, which highlights the significant effect of user expectation and the characteristics of the technological device on the interest in technology (Wang et al., 2021). How people view their physical fitness is thus perhaps more important than their objective (worse) physical performance.

The dissemination of technologies, such as virtual reality, exergame, fitness app, and robot coach, that promote exercise and physical activity that keep physically slow individuals more active and protect active individuals from functional decline caused by ageing could be important (Fasola & Matarić, 2013; Larsen et al., 2013; Lee et al., 2012). Encouraging the use of these technologies in physically slow individuals could alleviate the adverse effects of ageing (Vaziri et al., 2020). Moreover, adaptation to such technologies in the early phases of ageing (65–75) can improve the willingness to use technology in later life (>80).

The findings also showed that the interest of older adults in supportive technologies varied depending on their expectations and the perceived benefit of the technological devices. This variety of attitudes towards technology was also found in a recent study investigating the effects of socio-demographic and health factors on the willingness of elderly individuals to use emerging technologies in US older adults (Kadylak & Cotten, 2020). This large study ($n = 1148$) found that participants were more willing to use internet-connected technologies (camera and home appliances) and smart home technologies than virtual reality and autonomous vehicles. Similarly, a recently published systematic review by (Wang et al., 2021) found that use expectancy, which reflects an individual's beliefs about the potential benefits of using technology, as well as their confidence in their ability to use it effectively, affected older adults' willingness to use caregiving technologies, highlighting the importance of considering the users' expectations in the production and supply of home-based supportive technologies.

Healthcare providers, technology manufacturers and designers, and policymakers should consider the results of this study, which can improve technology adoption and acceptability in older people. Females and older people (>80) in general and those who do not have access to technology should be considered as target groups. Healthcare providers specialising in geriatric care, such as geriatricians, primary care physicians, nurses, and social workers, can inform older people about technology and help them access it. They may work in various settings, such as hospitals, clinics, community healthcare centres, and long-term care facilities. Additionally, some healthcare providers may collaborate with community organisations, libraries, and other public spaces to provide education and training on technology use for older adults. Our results showed that the only modifiable factor which mattered most in both types of technology was whether the respondents had access to those technologies. Therefore, policymakers at the national and local levels including officials within government departments or agencies responsible for health or ageing can facilitate access to technology, especially in older groups, and provide education and training to use those technologies, which would most probably increase the intention to use technology among older people. Another important factor can be for technology manufacturers and designers to design technological devices in line with the expectations and needs of older people. Working together with older people to better develop technology that suits their needs and abilities is important. Lastly, appropriate and robust testing of whether developed technology is effective in improving memory and independence is crucial.

Multi-centre studies with a larger number of participants from different ethnic groups should be conducted in future studies to see if these results reflect other groups, including older people in developing countries. In addition, considering these results, studies should be conducted to investigate how educational and policy interventions and service customisations together with service users affect the technology adaptation and willingness to use technology in the older population including those who have currently no access.

Conclusion

In conclusion, our study has shown which factors significantly affect the willingness of older adults in the UK to use technological devices which support their health and well-being. We found that age, gender, access to technology, and self-reported (but not objective) physically slowing down were significant predictors of willingness to use technology. Females and older people in general and people who do not have access to technology should be the target groups of healthcare providers working with technology developers. Our findings highlight that interventions aimed at improving technology access and knowledge of their benefits may be effective in increasing the adoption of technology among older adults. In particular, peer-based interventions that facilitate knowledge exchange and increase confidence in technology usage may prove to be promising strategies for augmenting technology adoption.

Note

1. Except for BMI (7.2%) and PA (7%).

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