The association between internet non-use and multidimensional frailty in older adults : a three-wave cross-sectional study from 2004 to 2021

Title

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Abstract

This study examined the association between frailty and internet (non-)use, using representative data – collected between 2004 and 2021 – of community dwelling people aged 60 and older living in Flanders, Belgium (N = 43,048). Multidimensional frailty was measured by the Comprehensive Frailty Assessment Instrument (CFAI), which is a reliable and valid instrument to assess physical, psychological, social and environmental dimensions of frailty. Internet use was dichotomised into users and non-users. Multivariable regression analyses revealed that the physical domain is the most strongly related frailty factor to internet (non-)use, and this has been a constant trend since 2004. Those in the high physical frailty group have the highest probabilities of being non-user and are up to 8.0% more likely to be non-user than those in the 'no-low' physical frailty group. Future research should investigate how human-technology interaction can be improved and make internet technologies more manageable for physical frail older adults. However, average marginal effects indicate that sociodemographic variables are more strongly related to internet (non-)use than frailty

domains. This result shows that internet non-use in older people is multifactorial in origin and not only attributed to their frailty status.

Keywords

internet non-use, digital exclusion, older people, frailty, multidimensional frailty

Main text

Introduction

Over the past years, internet has become more and more important in older adults' daily lives (Gao et al., 2020; van Boekel et al., 2017). It enables older people to connect with geographically dispersed family or friends, facilitates participation in leisure, social, cultural and civic activities and improves access to information and services (Arthanat et al., 2019; Bobillier Chaumon et al., 2014; Lagacé et al., 2015; Tsai et al., 2017). Moreover, the wide range of online applications and e-services provides opportunities for older adults to pursue an active, independent and socially connected life, even when they become housebound (Bobillier Chaumon et al., 2014; Neves et al., 2018; Peek et al., 2015; Sum et al., 2008).

Taking into account the importance of internet in daily life, the proportion of internet users has increased among all age groups over the last decades. However, older adults still lag behind other age groups in terms of internet access and use (Eurostat, 2020; Hargittai & Dobransky, 2017; Hunsaker & Hargittai, 2018; Lagacé et al., 2015). As studies by Arthanat et al. (2019) and Van Deursen and Helsper (2015a) have shown, the current generation of older people has lower levels of digital literacy and skills and is less likely to use internet than younger generations. One obvious reason is that the majority of them spent the bulk of their lives in the predigital era with limited or no availability of mobile phones, computers or internet. Other factors accounting for older adults' limited digital literacy include mental barriers such as technology anxiety, lack of technology-related self-efficacy, perceptions that digital technology is too difficult and too costly, feeling too old, little interest, no need for a 'virtual world', the expectation that being permanently online and connected with a virtual world may be a burden to wellbeing, its addictive nature and the fear that internet might consume valuable time that would be better spent on face-to-face-interactions (Attrill-Smith et al., 2020; Büchi et al., 2016; Gatto & Tak, 2008; Helsper & Reisdorf, 2016; Liao et al., 2020; Lüders & Brandtzæg, 2017; Mariano et al., 2022; Nguyen, 2021; Scheerder et al., 2017; van Deursen & Helsper, 2015a; Vanden Abeele & Nguyen, 2022).

Furthermore, since internet technologies are typically designed by younger people with the youth market in mind and rarely take into account the needs of older people (Ivan & Cutler, 2021; Pavić-Rogošić et al., 2022; Trentham et al., 2015), age-related changes or impairments, such as decline of fine motor skills, hearing loss or poor eyesight may also hinder certain older people from using internet (Berkowsky et al., 2013; Berner et al., 2019; Choi & Dinitto, 2013; Friemel, 2016; Hanson, 2010; Huxhold et al., 2020; Sanchiz et al., 2020). In this context, poor usability and complexity of devices and internet applications (Betlej & Danileviča, 2022; Webster & Ahuja, 2006) and the length of time and lack of patience to learn how to use them are barriers to internet use (Gatto & Tak, 2008). Furthermore, worries about privacy and security threats and fraudulent incidents such as identity theft, cyber hacking, phishing attacks or online scams, as well as concerns about the trustworthiness of internet sources and information, misleading or erroneous information and illegal content may discourage internet adoption (Gatto & Tak, 2008; Manuputty et al., 2013; Nasir et al., 2015). Indeed, internet non-use is a complex phenomenon with multiple reasons and non-users represent a heterogeneous group of people. For example, some have never used internet while others are so-called *ex-users* or *discontinuers* who have used internet before (Helsper & Reisdorf, 2016; Joseph, 2010; Ting, 2016). Also, a distinction can be made between those who lack access or necessary skills to become internet user – often called *have nots* – and those often labeled as *want nots* or *internet refusers* who made a deliberate and empowered choice to stay offline despite having resources or opportunities to (learn how to) use internet (Joseph, 2010; Ting, 2016; van Deursen & Helsper, 2015b; Van Dijk, 2005). However, non-use does not mean that those who are offline are completely disconnected from internet (technologies) since internet non-users often use internet by proxies and ask someone to do something online on their behalf (Dolničar et al., 2018; Petrovčič et al., 2022b; Reisdorf et al., 2021).

Despite a high number of research that focuses on internet (non-)use in older adults, there is not much research done in the field of internet use and frailty (Ollevier et al., 2020; Selak et al., 2019). Moreover, the scarce research that exists on internet use in frail older adults has mainly targeted family caregivers and focused on the question how internet technologies can support them in providing care for frail

older persons (Magnusson et al., 2004; Wasilewski et al., 2017). However, when research does focus on the use of internet technology by frail older persons themselves, the scope is often limited to home-based exercise programs stimulating physical activity among older frail adults (Geraedts et al., 2017). Indeed, in the limited number of studies on internet use in frail older people, frailty has almost always been conceptualized as a purely physical phenomenon, assessed by biomedical indicators like weight loss, hand grip strength, slowness in walking or inability to rise from a chair without using arms (Baek et al., 2022; Díaz-Ramos et al., 2018; Keränen et al., 2017). However, by focusing exclusively on biomedical indicators, the holistic view of older people is disregarded (Gobbens et al., 2010a). As a consequence, there is a growing consensus among frailty researchers to move away from a unidimensional biomedical perspective and broaden the scope by considering frailty as a result of complex interactions between physical, psychological and social factors (Gobbens et al., 2010b; Gobbens et al., 2010c; Gobbens & van der Ploeg, 2021; Roppolo et al., 2015). This bio-psycho-social approach was criticized because it does not take into account environmental factors. However, older people highly depend on the sustainability of their housing conditions and environment when ageing in place (Costa-Font et al., 2009; De Witte et al., 2013a; De Witte et al., 2018). Moreover, older adults can become frail as a result of environmental challenges such as poor-quality housing or deprived environments (De Witte et al., 2013a; Schröder-Butterfill & Marianti, 2006). Previous studies have shown that frailty in older people is related to adverse outcomes, such as disability (Liu et al., 2019), limitations in performing activities of daily living (Gobbens & van der Ploeg, 2021; Liu et al., 2019), lower quality of life (Kojima et al., 2016), hospitalization or institutionalization (Gobbens & van der Ploeg, 2021; Vermeiren et al., 2016) and mortality (Gobbens & van der Ploeg, 2021; Vermeiren et al., 2016).

Although internet technologies have the potential to enable older adults to remain in their own homes and familiar environment and age in place successfully (Peek et al., 2014; Selak et al., 2019), it remains unclear whether frail older adults use internet and how frailty relates to internet (non-)use. Furthermore, Petrovčič et al. (2022a) noticed that most research on internet (non-)use focuses on

younger populations or only includes the youngest old, for instance with a cut-off age of 75 or lower. Moreover, as mentioned in previous research (Helsper & Reisdorf, 2016; Hunsaker & Hargittai, 2018; Robinson et al., 2015), most studies on internet (non-)use in older adults rely on measurements at a single point in time or within short time frames and do not allow to monitor internet use in older people over larger time scales. Taking the aforementioned into account, this study aims to explore the relation between frailty and internet (non-)use among older adults, based on representative data – collected between 2004 and 2021 – of community dwelling people aged 60 and older (N = 43,048) living in Flanders (the Dutch speaking part of Belgium) with a proper representation of the oldest old.

Methods

Data collection and participants

The present study used data originating from the Belgian Ageing Studies (BAS), an ongoing cross-sectional survey study that has been running in municipalities in Flanders (the Dutch-speaking part of Belgium) since 2004. The BAS project aims to gather information from older people about their perceptions on various aspects related to quality of life and living conditions in later life. The project includes people aged 60 and older living at home (i.e. older people living in residential care facilities were excluded from the sample).

Data collection started in 2004 and is still ongoing in new municipalities. Municipalities are not selected randomly, but can freely decide to participate in the research project. In each of the participating municipalities, persons aged 60 and older are randomly selected from municipal registers and stratified by age and gender. Age classification is done according to WHO guidelines where participants were categorized into three subgroups: 60 - 69, 70 - 79 and 80 or older (World Health Organization, 2014). The stratified sampling procedure ensures that the sample matches the makeup of the underlying population in the community and that the 80+ age group is adequately represented, which is important as they are often excluded in previous research on internet use. Consequently, every sample is representative for the participating municipality.

Since 2004, data are collected using a peer research methodology. Thereby, older volunteers are actively involved in the data collection process. After training the volunteers visit older persons who are assigned to them and handed over the paper-based questionnaire. The questionnaire is self-administered, but on request, the volunteers are allowed to clarify questions or provide help when needed. When participants refused or were hampered to participate, replacement addresses in the same quota category were provided . The respondents are free to participate and their anonymity is guaranteed. The ethical committee of the Vrije Universiteit Brussel approved the study protocol (B.U.N. 143201111521).

For this study, we used BAS data collected between 2004 and 2021. A total of 82.580 older people living in 168 different municipalities in Flanders have participated in the BAS study. Respondents who did not respond to at least one of the five sociodemographic characteristics included in the current study or did not answer the questions concerning internet use and frailty were excluded for the analysis. This results in data of 43,048 respondents, which corresponds to 52.1% of the original sample of 82,580 respondents.

Questionnaire and study variables

In 2004, the BAS questionnaire has been developed in cooperation with the provincial government, provincial advisory board of older people, local authorities and members of local senior organizations. The questionnaire was reviewed by an expert panel of local policymakers and members of senior organizations to determine face validity of the instrument. Besides evaluating the clearness of the items, the expert panel was asked to determine whether each single item was applicable to the lifeworld of older people. Furthermore, the questionnaire was reviewed by academic researchers who examined whether the items fully represent underlying theoretical perspectives. Based on their recommendations and comments, some items were revised slightly concerning phrasing and clarity and ruling out ambiguity (De Donder et al., 2015).

Between 2004 and 2021, the questionnaire was two times slightly modified in order to meet the expectations of local policymakers. As a consequence, the dataset can be divided into three waves (=time periods), based on the time the modification took place: 2004 - 2009, 2010 - 2015 and 2016 - 2021. A full description of the methodology can be found in De Witte et al. (2013a; 2018).

Internet use

In the BAS-survey internet use is assessed by asking respondents “How often do you use internet?”. Response categories were never (=0), less than weekly (=1), weekly (=2), daily (=3) and several times a day (=4). As this study focusses on internet non-use, we dichotomised internet use into non-use (=1) and use (=0) (by grouping together the response categories 1 - 4), with internet users being the reference group.

The Comprehensive Frailty Assessment Instrument (CFAI)

The CFAI is a multidimensional frailty instrument developed to screen frailty in community-dwelling older people. This self-administered instrument comprises 23 items capturing the physical, psychological, social and environmental frailty and has shown good psychometric properties (De Witte et al., 2013a). Physical frailty is operationalized through four items related to the general health of the participants. Mood disorders (five items) and emotional loneliness (three items) determine psychological frailty; social loneliness (three items) and potential social support network (three items) determine social frailty. Finally, the instrument assesses environmental frailty by five statements regarding the condition and location of participants' home. For a full description of the CFAI, see De Witte et al. (2013a). Scores for each frailty domain – the physical, psychological, social and environmental one – range from 0 to 25, with higher scores referring to higher frailty (De Witte et al., 2013b). The total score of the CFAI is obtained by summing the four domain scores, resulting in a score ranging from 0 to 100. The higher the score, the more frail the respondent. The frailty domain scores (0-25) and the total frailty score (0-100) were classified into three classes (no - low, mild and high) using the developers' instructions (De Witte et al., 2018). The CFAI was previously validated, using a second-order confirmatory factor analysis and cross-validated against The Tilburg Frailty Indicator (De Witte et al., 2013a; De Witte et al., 2013b).

Sociodemographic covariates

Additional variables included as covariates were age, gender, marital status, educational level and monthly household income. Age was assessed by asking the respondents their age in years and was, in line with the stratified sampling procedure, recoded into 60 - 69 years old (=0), 70 - 79 years old (=1) and 80 years and older (=2). The youngest age group served as reference group in regression analyses. Gender was measured as a dichotomous variable (0=men, 1=women), with the first group serving as reference group. Marital status was coded as married (=0), never married (=1), divorced (=2), cohabiting (=3) and widowed (=4). Married served as reference group. Education was categorized into four groups: no degree or primary education (=0), lower secondary (=1), higher secondary (=2) and

higher education (=3). The higher educated served as reference group. Finally, net monthly household income had four categories: ≤ €999 (=0), €1000-1499 (=1), €1500-1999 (=2) and ≥ €2000 (=4). The highest income class was used as reference group.

Data analysis

First, data were grouped in three 6-calendar-year intervals in correspondence to the three waves of datacollection in BAS (Wave-1: 2004 - 2009; Wave-2: 2010 - 2015; Wave-3: 2016 - 2021). Second, descriptive statistics were used to examine characteristics of respondents in these three waves (presented in table 1 and table 2). Third, for each wave separately, chi-square analyses (presented in table 3) and univariate and multivariable logistic regression analyses (presented in table 4 and table 5 respectively) were performed to assess associations between internet (non-)use and multidimensional frailty. The independent variables that were statistically associated in the univariate analyses entered the multivariable logistic regression models. Prior to multivariable modeling, the relevant assumptions of this statistical analysis were tested. First, given the large sample size in the three wave groups, our data provide sufficient events per variable required to perform valid logistic regression analyses (Courvoisier et al., 2011; Peduzzi et al., 1996). Second, although Spearman correlation coefficients showed weak to moderate associations between some independent variables (the highest Rho value was -0.421; see Table 1), all Variance Inflation Factors were below 2.5, ranging between 1.05 and 2.22, indicating no collinearity in the data. Furthermore, we tested for interactions between independent variables but all interaction terms were not statistically associated with the dependent variable and thus not retained in multivariable regression analyses.

<< table 1 >>

Regression results are presented using Average Marginal Effects (AMEs), 95% confidence intervals (CI) and exact p-values. We preferred to report AMEs over Odds Ratios (OR), as ORs are hard to interpret (Daniel et al., 2021; Pang et al., 2016; Schuster et al., 2021), only indicate the direction of the relation between independent variables and the dependent variable and do not reveal the strength of the relation in terms of probabilities. By contrast, AMEs provide probability-based interpretations and

estimate the average of predicted change in the probability of being internet non-user associated with a one-unit (for continuous variables) or a categorical change (for dichotomous variables) in a particular variable controlling for other covariates (Mood, 2010; Niu, 2020). AMEs were calculated for each independent variable by computing individual marginal effects for each case and, subsequently, averaging all individual marginal effects (Gallani et al., 2015; Mood, 2010; Niu, 2020). Goodness of fit of the regression models has been measured by evaluating Nagelkerke's pseudo R^2 and describing the percentage of observations (i.e. older adults) correctly mapped onto the categorical outcome (i.e. user or non-user classes). We also report the −2 Log Likelihood to indicate model fit. All statistical analyses were performed using SPSS 25.0 (IBM, SPSS, Armonk, NY: IBM Corp) and Stata SE 17 (Stata Corp LLC, College Station, TX, USA). Given the large sample size, statistical significance was set at $p < 0.001$ (Field, 2017).

Results

Respondents' sociodemographic characteristics

Table 2 presents the sociodemographic characteristics of the respondents over the three waves of BAS. Slightly more than half of the respondents were women, both in the first, second and third wave. Approximately one in five were 80 years or older, which was, again, the case in the three waves. With regard to education, 36.9% of the respondents who participated in the survey between 2004 and 2009 had no degree or only primary education, whereas this was the case for 27.8% and 18.7% of the respondents in Wave-2 and Wave-3 respectively. Correspondingly, the amount of people with higher secondary and higher education increased. Similarly, the proportion of respondents with a net monthly household income of 2000 euro and more was lower in Wave-1 (21.6%) than in Wave-2 (35.7%) and Wave-3 (55.2%). Approximately three quarter of the sample was married, both in Wave-1 (70.8%), Wave-2 (71.1%) and Wave-3 (71.3%). With regard to internet use, the proportion of non-users decreased from 72.3% in Wave-1 to 51.6% in Wave-2 and 25.9% in Wave-3 (see Table 2).

<< table 2 >>

CFAI's multidimensional frailty scores

With regard to the total frailty score, 22.9% of the respondents in Wave-1 scored high on total frailty, whereas this was the case for 21.4% and 18.8% of the respondents in Wave-2 and Wave-3 respectively. Looking at the subdomains, 16.5% of the first-wave sample scored high on physical frailty, which was 15.4% in Wave-2 and 10.9% in Wave-3. Similarly, with regard to environmental frailty, 14.9% of the respondents in Wave-1 were classified as highly frail, while this was the case for 14.7% in Wave-2 and 12.4% in Wave-3. With regard to psychological frailty, approximately one in twelve were rated as highly frail, both in Wave-1 (8.9%), Wave-2 (8.7%) and Wave-3 (8.1%). Finally, approximately one in five belongs to the highest level of social frailty, both in Wave-1 (21.5%), Wave-2 (21.0%) and Wave-3 (22.2%). All frailty prevalence rates can be found in table 3.

<< table 3 >>

Internet (non-)use according to frailty status

Table 4 presents the bivariate statistics for the relation between frailty and internet (non-)use. Regarding the total frailty score, among the internet users, approximately one in ten belongs to the highly frail group, both in Wave-1 (11.4%), Wave-2 (13.2%) and Wave-3 (13.7%). By contrast, among internet non-users, there were more people who scored high on total frailty (27.3% in Wave-1, 29.2% in Wave-2 and 33.1% in Wave-3).

Regarding the frailty subdomains, the majority of older adult internet users scored 'no-low' on physical frailty (80.1% in Wave-1, 77.2% in Wave-2 and 78.2% in Wave-3), psychological frailty (69.4% in Wave-1, 69.2% in Wave-2 and 68.2% in Wave-3) and environmental frailty (59.3% in Wave-1, 57.5% in Wave-2 and 60.0% in Wave-3). Similarly, within internet non-users, the majority scored 'no-low' on physical frailty (59.2% in Wave-1, 56.3% in Wave-2 and 53.6% in Wave-3), psychological frailty (59.3% in Wave-1, 58.7% in Wave-2 and 59.1% in Wave-3) and environmental frailty (51.0% in Wave-1, 50.9% in Wave-2 and 50.7% in Wave-3). However, the percentages of no-low frail respondents were lower among non-users than those observed in internet users. Correspondingly, we see systematically larger percentages of high physical, psychological and environmental frailty among the internet non-users. Regarding social frailty, the differences between internet-users and non-users were substantially smaller than for the other frailty domains. About one in three internet users from Wave-1 and Wave-2 (resp. 32.5% and 35.2%) were classified as 'no-low' on social frailty, decreasing to one in four in Wave-3 (25.0%). Among internet non-users there were less people with no-low social frailty (31.7% in Wave-1, 30.2% in Wave-2 and 22.4% in Wave-3). Correspondingly, the percentages of high social frailty were higher among internet non-users (21.9% in Wave-1, 22.4% in Wave-2 and 30.5% in Wave-3) than among internet users (20.4% in Wave-1, 19.5% in Wave-2 and 19.3% in Wave-3).

<< table 4 >>

Table 5 presents the average marginal effects for all univariate logistic regression analyses. The average marginal effects show that those in the high physical frailty group were – since 2004 – at least 20% more likely to be internet non-user (20.7% in Wave-1, 27.3% in Wave-2 and 25.0% in Wave-3)

than those scoring ‘no-low’ on physical frailty. Similarly, mild physical frailty was associated with a 9.5 percentage point increase – compared to those classified as ‘no-low’ on physical frailty – in the probability of being non-user in Wave-1, up to a 11.1 and 16.1 percentage point increase in Wave-2 and Wave-3 respectively. The other frailty domains were consistently, since 2004, less strongly associated with internet non-use as those in the mild and high frailty groups had lower marginal effects – both for psychological, social and environmental frailty – than those scoring mild or high on physical frailty.

<< table 5 >>

Based on the results of the univariate analyses, all variables shown to be associated with internet (non-)use (see table 5) and were – as mentioned in the Methods section – included in multivariable regression analyses. In the multivariable regression models (see table 6), physical frailty still had the highest average marginal effects on internet non-use. Those scoring high on physical frailty were up to 8.0 per cent more likely to be internet non-user (6.0% in Wave-1, 8.0% in Wave-2 and 7.3% in Wave-3) than those in the ‘no-low’ physical frailty group. However, these average marginal effects were lower than in univariate analyses. Similarly, marginal effect sizes of those with mild physical frailty decreased in the multivariable analyses compared to the univariate regression models, resulting in marginal effects ranging from 1.8% in Wave-1 to 3.8% in Wave-2 and 5.4% in Wave-3.

Furthermore, multivariable regression analyses revealed higher average marginal effects for sociodemographic variables compared with frailty factors, indicating that sociodemographic characteristics are more strongly associated with internet (non-)use. The probability of being non-user was consistently higher for women (7.8% in Wave-1, 6.8% in Wave-2 and 8.0% in Wave-3) than for men. Similarly, in the three wave groups, people aged 70 - 79 and those aged 80 and older consistently had higher probabilities of non-use than those aged 60 - 69, with the oldest old (80+) being up to 30.2% more likely to be non-user (21.2% in Wave-1, 29.0% in Wave-2 and 30.2% in Wave-3) than those aged 60 to 69. Also, lower education consistently increased the probability of being non-user, with marginal

effects showing that those who obtained no degree or only primary education were up to 34.0% more likely to be non-user (30.4% in Wave-1, 27.9% in Wave-2 and 34.0% in Wave-3) than those with higher education. Similarly, higher probabilities of non-use were consistently found in those with lower income, which was again true in all three waves. Marginal effects show an increase in the likelihood of being non-user by 14.1% (Wave-1), 26.3% (Wave-2) and 23.9% (Wave-3) for those who had a net household income of less than 1000 euro/month. Finally, with regard to marital status, those who were never married were the only group who consistently, since 2004, had positive marginal effects on internet non-use. However, these marginal effects were substantially lower (2.5% in Wave-1, 2.2% in Wave-2 and 11.4% in Wave-3) with higher p-values than the other sociodemographic variables.

<< table 6 >>

Discussion

Being online has become crucial in order to be included and participate in modern society (Meisner, 2021; Nimrod, 2021). Moreover, internet technologies have the potential to enable older adults to remain in their own homes and familiar environment and pursue an active, independent and socially connected life (Peek et al., 2014; Selak et al., 2019). However, it remains unclear whether frail older adults use internet and how frailty relates to internet (non-)use as there is not much research being done in the field of internet use and frailty (Ollevier et al., 2020; Selak et al., 2019). Moreover, most studies on internet (non-)use in older people exclude the oldest old and are based on measurements at a single point in time and are unable to monitor over time changes in internet (non-)use. In this context, our study is an important addition to current literature, as it is the first to investigate the association between frailty and internet (non-)use among community dwelling older people over almost two decades (2004 - 2021). Therefore, this study used a vast and representative sample, originating from the Belgian Ageing Studies (BAS), of 43,048 older people living at home in Flanders (the Dutch-speaking region of Belgium) with a proper representation of the oldest old.

Using multivariable logistic regression analyses and comparing average marginal effects of physical, psychological, social and environmental frailty on internet (non-)use (see table 6), our study revealed that the physical domain is – since 2004 – the most strongly related to internet (non-)use, with those in the high physical frailty group having the highest probabilities of being non-user (being up to 8.0% more likely to be non-user than those in the 'no-low' physical frailty group). This result aligns with previous research which indicated that physical changes, such as decline of fine motor skills, declining eyesight or hearing loss can contribute to difficulties in using internet technologies (Berkowsky et al., 2013; Berner et al., 2019; Choi & Dinitto, 2013; Friemel, 2016; Hanson, 2010; Huxhold et al., 2020; Sanchiz et al., 2020). However, when comparing average marginal effects of sociodemographic characteristics and frailty domains on internet (non-)use, we found that sociodemographic variables were more strongly related to internet (non-)use than frailty domains. We found that women, the oldest old, the lowest educated and those in the lowest income class are consistently, between 2004

and 2021, more likely to be internet non-use, which is in line with previous research (Berner et al., 2015; Borg & Smith, 2018; Choi & Dinitto, 2013; Dixon et al., 2014; Friemel, 2016; Hargittai & Dobransky, 2017; Hunsaker & Hargittai, 2018; König et al., 2018; Tuikka et al., 2018; van Deursen & Helsper, 2015a; Vulpe & Craciun, 2020).

Our findings underscore the need to approach internet non-use in older people holistically and – as mentioned by Kouvonen et al. (2022) – to recognize that internet (non-)use among older adults can only be explained by multiple factors and is not determined by frailty status alone. The result that even frail older adults are able to use internet – bivariate analyses showed that approximately one in two of the internet users scored mild or high on the CFAI-Total Frailty score, both in Wave-1 (44.4%), Wave-2 (45.9%) and Wave-3 (46.2%) – offers a promising perspective, given the fact that an increasing number of companies, governments and authorities are moving their services online and expect that all people – including frail older persons – follow the dominant technological culture (Ingaldi & Brožovà, 2020; Lombardo et al., 2021).

Practical implications

Since almost every aspect of everyday life is permeated by digital technologies, being online has become more and more necessary (Gao et al., 2020). In order to promote digital inclusion, user-friendliness of internet applications and devices should be improved (Brasit & Nursyamsi, 2017). In this context, the fact that our results show that those scoring high on physical frailty were up to 8.0% more likely to be internet non-user can be considered as a call for technology developers and designers to take into account older persons' needs and create barrier-free interfaces tackling physical limitations that inhibit the adoption of internet technologies. Indeed, the association between physical frailty and internet non-use points to the need to investigate how interfaces can be improved and can make internet technologies more accessible and manageable. However, the result that mild and even high psychological, social and environmental frailty are weakly and not consistently related to internet non-use provides an incentive to consider ageing not as a synonym for incapability and to recognize older adults' ability – even if they are frail – to learn new skills and using technologies. Similarly, our result

that the relation between physical frailty and non-use is not as strong as the relation between sociodemographic backgrounds and non-use, shows that internet non-use among older people needs to be treated as more than merely a result of frailty or functional decline. These insights are of great importance as stereotypes about older persons and technology use must be taken into account and deconstructed in order to enable digital inclusion in older people (Chalghoumi et al., 2022).

Furthermore, our findings help identify groups at risk of being digitally excluded. Results from logistic regression analyses indicate that not using internet is consistently associated with specific sociodemographic backgrounds showing that women, the oldest old, the lowest educated and those in the lowest income class consistently, since 2004, have higher probabilities of being offline. These insights can help policymakers and internet training providers to identify non-users in the population of older people and target those who may particularly benefit from e-inclusion initiatives. Moreover, as those who obtained no degree or only primary education are up to 34.0% more likely to be non-user, greater attention is needed – as mentioned by Calhoun and Lee (2019) – to develop e-inclusion programs tailored to the needs of those who have had limited educational opportunities during earlier stages in life. Furthermore, the association between low income and high probabilities of non-use calls for policy actions that tackle economic inequalities preventing older adults from using internet (Reisdorf & Groselj, 2017). As low economic status may serve as a barrier to purchase internet devices and internet connectivity services (Calhoun & Lee, 2019; Lee et al., 2011), policies should be stimulated to make internet accessible for all citizens, including older adults with low income levels (Krug et al., 2018).

Limitations and further research

A first limitation is the cross-sectional design of this study, which only allows associations to be made and does not allow to conclude causal relations. Therefore, longitudinal studies are required to provide stronger support for the tested associations. Second, data were based on self-reporting, which may result in social desirability bias. However, frailty was assessed by the Comprehensive Frailty Assessment Instrument (CFAI) which is a reliable and valid instrument to measure multidimensional

frailty (De Witte et al., 2013a). Older adults who were not able to fill in the survey (for instance as a result of high physical frailty) were allowed to request and have assistance from the volunteer, which may reduce the risk of selection bias. Third, due to COVID-19 the number of respondents in the last wave was lower than expected, which may explain why the third multivariable regression model had lower explanatory quality as shown by lower percentage of correct classification of non-users. However, this is – to the best of our knowledge – the first study on internet non-use based on a vast and representative sample of more than 40,000 older adults. Moreover, descriptive statistics provide support for the robustness of our dataset. First, the result that the proportion of people aged 80 and above increased from 16.0% in Wave-1 to 18.2% in Wave-2 and 19.1% in Wave-3 is in line with the ageing trend of the population and the bigger share of people aged 80 and older (United Nations, 2019). Similarly, the proportion of men and women in our study – slightly more than half of the sample were women, both in Wave-1, Wave-2 and Wave-3 – is in line with the distribution of men and women in Flanders between 2004 (44.4% and 55.6% respectively) until 2021 (44.3% and 55.7% respectively) (Statbel, 2021). The finding that our sample contains more higher educated people in Wave-3 – 29.0% attained the highest educational level – compared to Wave-2 (20.4%) and Wave-1 (14.5%) can be related to increasing compulsory schooling age in Belgium since the 1950s (Murtin & Viarengo, 2011). Since previous research has shown that higher educated older people are less likely to be frail (Etman et al., 2012) it is not surprising that there are less respondents who are frail in Wave-3 – 18.8% scored high on the CFAI-Total Frailty score – compared to Wave-2 (21.4%) and Wave-1 (22.9%). As higher education levels strongly correlate with higher income levels and wages are indexed to inflation (Checchi & Lucifora, 2002), it is explainable that our dataset contains higher proportions of people with a net monthly household income of at least 2000 euro in the third wave group (55.2%) than in the second (35.7%) and first one (21.6%). Similarly, the result that the prevalence of internet non-users is higher in Wave-1 (72.3%) than in Wave-2 (51.6%) and Wave-3 (25.9%) – which is in line with previous research (Eurostat, 2020) – gives an indication that our dataset is suitable to investigate the relation between frailty and internet (non-)use among older adults.

A fourth limitation is the binary approach between internet non-users and users. In doing so, we did not focus on the variety in frequency of internet use, nor on the types of internet activities and devices frail older people use. We recommend further research to focus on the continuum between non-use and use – as was suggested by Neves et al. (2018) – as well as to establish what internet activities and devices older people interact with and how frailty relates to differences in online behavior. Fifth, this study does not offer a comprehensive view of the social context of internet (non-)use. As a consequence, it does not allow to separate independent internet users from assisted users who receive support from others. Similarly, we are unable to verify whether the non-users we identified, ask other people to do things online on their behalf, although previous research suggested that *users-by-proxy* are fairly widespread among non-users (Dolničar et al., 2018; Petrovčič et al., 2022b; Reisdorf et al., 2021). Future research should provide insights into the underlying contextual factors of internet (non-)use and investigate whether non-users seek alternative ways of using internet and how these strategies relate to frailty status of older adults. A sixth shortcoming might be that the sample only contained people living in Flanders (the Dutch speaking part of Belgium). However, in several aspects the situation in Flanders is comparable to other developed countries. Indeed, the dominant ageing-in-place policy in many Western countries (Magnusson & Hanson, 2005) and high internet penetration rates (Eurostat, 2020) lead to increasing interest in and attention to internet technologies enabling older people, even if they are frail, to remain in their own homes for as long as possible and age in place successfully (Peek et al., 2014; Selak et al., 2019). As a consequence, the question whether frail older adults use internet is not only a Flemish concern but very much an international one. In this context, the results of this study may be relevant for other developed countries as well.

Conclusion

Being online has become necessary for functioning in modern society. In this context the proportion of older internet users has increased steadily over the past years. Despite a high number of research that focuses on internet (non-)use in older adults, it remains unclear whether frail older people use internet and how frailty relates to internet non-use. Therefore, this study investigated the association

between frailty and internet (non-)use among community dwelling older people, using three vast and representative cross-sectional samples – spanning almost two decades (i.e. 2004 - 2009, 2010 - 2015 and 2016 - 2021) – of community dwelling people aged 60 and older (N = 43,048). Using multivariable logistic regression analyses, average marginal effects of physical, psychological, social and environmental frailty on internet (non-)use show that physical frailty is the most strongly related to internet (non-)use. Those scoring high on physical frailty had the highest probabilities of being non-user and were up to 8.0% more likely to be non-user than those in the 'no-low' physical frailty group. However, when comparing average marginal effects of sociodemographic characteristics and frailty, we found that sociodemographic variables were more strongly related to internet (non-)use than frailty domains. Women, the oldest old, the lowest educated and those in the lowest income class are consistently, between 2004 and 2021, more likely to be internet non-use. These results show that internet non-use in older people is multifactorial in origin and not only attributed to their frailty status..

Ethics approval

This study was approved by the ethical committee of the Vrije Universiteit Brussel (B.U.N. 143201111521).

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Tables

Table 1

Table 1: Spearman's rho for all independent variables and the dependent variable.										
	1	2	3	4	5	6	7	8	9	10
2004 - 2009										
1. Gender		0.097	-0.145	-0.157	0.254	0.146	0.095	0.018	0.012	0.178
2. Age	0.097		-0.254	-0.263	0.298	0.334	0.114	-0.004	0.081	0.335
3. Education	-0.145	-0.254		0.422	-0.164	-0.216	-0.099	0.011	-0.104	-0.433
4. Income	-0.157	-0.263	0.422		-0.353	-0.206	-0.129	-0.027	-0.130	-0.351
5. Marital status	0.254	0.298	-0.164	-0.353		0.186	0.182	0.074	0.088	0.184
6. Physical frailty	0.146	0.334	-0.216	-0.206	0.186		0.236	0.071	0.114	0.206
7. Psychological frailty	0.095	0.114	-0.099	-0.129	0.182	0.236		0.211	0.209	0.101
8. Social frailty	0.018	-0.004	0.011	-0.027	0.074	0.071	0.211		0.075	0.013
9. Environmental frailty	0.012	0.081	-0.104	-0.130	0.088	0.114	0.209	0.075		0.084
10. Internet (non-)use	0.178	0.335	-0.433	-0.351	0.184	0.206	0.101	0.013	0.084	
2010 - 2015										
1. Gender		0.084	-0.113	-0.143	0.224	0.143	0.092	0.022	0.003	0.149
2. Age	0.084		-0.238	-0.251	0.258	0.318	0.082	0.038	0.055	0.358
3. Education	-0.113	-0.238		0.372	-0.139	-0.201	-0.111	-0.017	-0.075	-0.376
4. Income	-0.143	-0.251	0.372		-0.346	-0.208	-0.148	-0.073	-0.115	-0.380
5. Marital status	0.224	0.258	-0.139	-0.346		0.182	0.190	0.093	0.097	0.178
6. Physical frailty	0.143	0.318	-0.201	-0.208	0.182		0.218	0.102	0.113	0.233
7. Psychological frailty	0.092	0.082	-0.111	-0.148	0.190	0.218		0.241	0.231	0.114
8. Social frailty	0.022	0.038	-0.017	-0.073	0.093	0.102	0.241		0.109	0.055
9. Environmental frailty	0.003	0.055	-0.075	-0.115	0.097	0.113	0.231	0.109		0.085
10. Internet (non-)use	0.149	0.358	-0.376	-0.380	0.178	0.233	0.114	0.055	0.085	
2016 - 2021										
1. Gender		0.026	-0.109	-0.141	0.185	0.097	0.105	0.010	0.028	0.162
2. Age	0.026		-0.115	-0.138	0.142	0.269	0.058	0.069	-0.046	0.324
3. Education	-0.109	-0.115		0.350	-0.100	-0.205	-0.109	-0.080	-0.089	-0.348
4. Income	-0.141	-0.138	0.350		-0.421	-0.190	-0.166	-0.150	-0.139	-0.312
5. Marital status	0.185	0.142	-0.100	-0.421		0.125	0.193	0.138	0.040	0.184
6. Physical frailty	0.097	0.269	-0.205	-0.190	0.125		0.240	0.131	0.070	0.245
7. Psychological frailty	0.105	0.058	-0.109	-0.166	0.193	0.240		0.282	0.244	0.103
8. Social frailty	0.010	0.069	-0.080	-0.150	0.138	0.131	0.282		0.132	0.087
9. Environmental frailty	0.028	-0.046	-0.089	-0.139	0.040	0.070	0.244	0.132		0.097
10. Internet (non-)use	0.162	0.324	-0.348	-0.312	0.184	0.245	0.103	0.087	0.097	

Table 2

Table 2: respondents' sociodemographic characteristics (n = 43,048).						
	Wave-1 (2004 - 2009)		Wave-2 (2010 - 2015)		Wave-3 (2016 - 2021)	
	%	n	%	n	%	n
Age						
60 - 69	49.6	16,278	49.1	4001	49.2	1016
70 - 79	34.4	11,311	32.7	2662	31.7	653
80+	16.0	5250	18.2	1483	19.1	394
Gender						
Men	49.0	16,080	49.3	4020	49.7	1026
Women	51.0	16,759	50.7	4126	50.3	1037
Marital status						
Married	70.8	23,260	71.1	5793	71.3	1471
Not married	3.4	1110	3.7	302	4.2	87
Divorced	3.5	1154	5.2	426	7.3	151
Cohabiting	1.8	581	2.2	178	2.3	47
Widowed	20.5	6734	17.8	1447	14.9	307
Educational level						
No degree or primary education	36.9	12,109	27.8	2265	18.7	386
Lower secondary education	29.3	9618	27.8	2263	28.3	584
Higher secondary education	19.3	6343	24.0	1954	23.9	494
Higher education (university college or university)	14.5	4769	20.4	1664	29.0	599
Income						
≤ €999	20.1	6598	8.7	710	4.2	86
€1000 - €1499	35.6	11,679	31.6	2573	19.2	397
€1500 - €1999	22.7	7460	24.0	1952	21.4	441
≥ €2000	21.6	7102	35.7	2911	55.2	1139
Internet user						
No	72.3	23,742	51.6	4206	25.9	535
Yes	27.7	9097	48.4	3940	74.1	1528

Table 3

Table 3: respondents' frailty scores (n = 43,048).						
	Wave-1 (2004 - 2009)		Wave-2 (2010 - 2015)		Wave-3 (2016 - 2021)	
	%	n	%	n	%	n
Physical frailty						
No – low	65.0	21,354	66.4	5410	71.8	1482
Mild	18.5	6062	18.1	1478	17.3	357
High	16.5	5423	15.4	1258	10.9	224
Psychological frailty						
No – low	62.1	20,389	63.8	5195	65.8	1358
Mild	29.0	9513	27.5	2242	26.0	537
High	8.9	2937	8.7	709	8.1	168
Social frailty						
No - low	31.9	10,484	32.6	2657	24.3	502
Mild	46.6	15,307	46.4	3780	53.5	1103
High	21.5	7048	21.0	1709	22.2	458
Environmental frailty						
No – low	53.3	17,509	54.1	4406	57.6	1188
Mild	31.8	10,427	31.2	2540	30.0	619
High	14.9	4903	14.7	1200	12.4	256
Total frailty						
No - low	42.6	13,993	44.2	3603	47.5	980
Mild	34.5	11,318	34.3	2796	33.7	696
High	22.9	7528	21.4	1747	18.8	387

Table 4

Table 4: differences in internet use according to frailty status.						
	Wave-1 (2004 - 2009)		Wave-2 (2010 - 2015)		Wave-3 (2016 - 2021)	
	Users (n=9097)	Non-users (n=23,742)	Users (n=3940)	Non-users (n=4206)	Users (n=1528)	Non-users (n=535)
Physical frailty						
No – low	80.1%	59.2%	77.2%	56.3%	78.2%	53.6%
Mild	13.7%	20.3%	14.7%	21.3%	14.2%	26.2%
High	6.2%	20.5%	8.1%	22.3%	7.6%	20.2%
χ2 (p-value)	1411.5 (< 0.001)		450.4 (< 0.001)		124.0 (< 0.001)	
Psychological frailty						
No – low	69.4%	59.3%	69.2%	58.7%	68.2%	59.1%
Mild	25.2%	30.4%	24.2%	30.7%	25.9%	26.4%
High	5.3%	10.3%	6.6%	10.7%	5.9%	14.6%
χ2 (p-value)	353.2 (< 0.001)		105.9 (< 0.001)		41.8 (< 0.001)	
Social frailty						
No - low	32.5%	31.7%	35.2%	30.2%	25.0%	22.4%
Mild	47.1%	46.4%	45.3%	47.4%	55.7%	47.1%
High	20.4%	21.9%	19.5%	22.4%	19.3%	30.5%
χ2 (p-value)	7.8 (0.020)		25.3 (< 0.001)		28.8 (< 0.001)	
Environmental frailty						
No – low	59.3%	51.0%	57.5%	50.9%	60.0%	50.7%
Mild	30.1%	32.4%	31.4%	30.9%	29.5%	31.6%
High	10.6%	16.6%	11.1%	18.1%	10.5%	17.8%
χ2 (p-value)	249.3 (< 0.001)		84.9 (< 0.001)		23.3 (< 0.001)	
Total frailty						
No - low	55.6%	37.6%	54.1%	35.0%	53.8%	29.5%
Mild	33.0%	35.0%	32.7%	35.8%	32.5%	37.4%
High	11.4%	27.3%	13.2%	29.2%	13.7%	33.1%
χ2 (p-value)	1229.7 (< 0.001)		414.4 (< 0.001)		131.0 (< 0.001)	

Table 5

Table 5: results of univariate logistic regression models with internet use as dependent variable (reference group: users); Wave-1 (2004 - 2009), Wave-2 (2010 - 2015) and Wave-3 (2016 - 2021).									
	Wave-1			Wave-2			Wave-3		
	AME	95% CI	p-value	AME	95% CI	p-value	AME	95% CI	p-value
Physical frailty: no-low (ref.)									
Mild	0.095	0.081; 0.108	< 0.001	0.111	0.083; 0.138	< 0.001	0.161	0.106; 0.215	< 0.001
High	0.207	0.198; 0.217	< 0.001	0.273	0.246; 0.300	< 0.001	0.250	0.182; 0.318	< 0.001
Psychological frailty: no-low (ref.)									
Mild	0.051	0.040; 0.061	< 0.001	0.082	0.057; 0.106	< 0.001	0.004	- 0.039; 0.048	0.843
High	0.122	0.108; 0.137	< 0.001	0.128	0.091; 0.165	< 0.001	0.223	0.145; 0.301	< 0.001
Social frailty: no-low (ref.)									
Mild	- 0.005	- 0.015; 0.004	0.280	0.021	- 0.001; 0.043	0.060	- 0.066	- 0.104; - 0.028	0.001
High	0.017	0.005. 0.028	0.005	0.043	0.017; 0.070	0.001	0.124	0.076; 0.173	< 0.001
Environmental frailty: no-low (ref.)									
Mild	0.021	0.011; 0.031	< 0.001	- 0.006	- 0.029; 0.017	0.616	0.020	- 0.022; 0.061	0.357
High	0.094	0.081; 0.106	< 0.001	0.140	0.111; 0.170	< 0.001	0.128	0.065; 0.190	< 0.001
Gender: men (ref.)									
Women	0.160	0.150; 0.169	< 0.001	0.149	0.128; 0.171	< 0.001	0.142	0.104; 0.179	< 0.001
Age: 60-69 (ref.)									
70-79	0.167	0.158; 0.176	< 0.001	0.115	0.092; 0.138	< 0.001	0.051	0.009; 0.092	0.017
80+	0.262	0.253; 0.270	< 0.001	0.374	0.351; 0.397	< 0.001	0.326	0.273; 0.379	< 0.001
Educational level: higher education (ref.)									
Higher secondary	- 0.184	- 0.197; - 0.171	< 0.001	- 0.153	- 0.178; - 0.128	< 0.001	- 0.072	- 0.114; - 0.030	0.001
Lower secondary	0.070	0.060; 0.080	< 0.001	0.085	0.061; 0.109	< 0.001	0.037	- 0.006; 0.080	0.089
No degree or primary education	0.303	0.295; 0.311	< 0.001	0.331	0.309; 0.353	< 0.001	0.363	0.310; 0.416	< 0.001
Income: ≥ €2000 (ref.)									
€1500 - €1999	- 0.055	- 0.067; - 0.044	< 0.001	0.004	- 0.021; 0.030	0.750	0.034	- 0.014; 0.081	0.163
€1000 - €1499	0.160	0.151; 0.170	< 0.001	0.274	0.252; 0.296	< 0.001	0.256	0.203; 0.309	< 0.001
≤ €999	0.212	0.203; 0.222	< 0.001	0.289	0.257; 0.322	< 0.001	0.360	0.255; 0.465	< 0.001
Marital status: married (ref.)									
Never married	0.065	0.040; 0.089	< 0.001	0.100	0.044; 0.156	< 0.001	0.161	0.056; 0.267	0.003
Divorced	- 0.060	- 0.087; - 0.032	< 0.001	- 0.089	- 0.137; - 0.041	< 0.001	- 0.044	- 0.113; 0.025	0.210
Cohabiting	- 0.119	- 0.159; - 0.079	< 0.001	- 0.143	- 0.215; - 0.071	< 0.001	- 0.091	- 0.200; 0.018	0.101
Widowed	0.224	0.215; 0.233	< 0.001	0.276	0.250; 0.301	< 0.001	0.254	0.195; 0.313	< 0.001

Table 6

Table 6: Results of multivariable logistic regression models with internet use as dependent variable (reference group: users); Wave-1 (2004 - 2009), Wave-2 (2010 - 2015) and Wave-3 (2016 - 2021).									
	Wave-1			Wave-2			Wave-3		
	AME	95% CI	p-value	AME	95% CI	p-value	AME	95% CI	p-value
Physical frailty: no-low (ref.)									
Mild	0.018	0.007; 0.030	0.001	0.038	0.014; 0.063	0.002	0.054	0.010; 0.098	0.016
High	0.060	0.046; 0.073	< 0.001	0.080	0.050; 0.110	< 0.001	0.073	0.017; 0.130	0.011
Psychological frailty: no-low (ref.)									
Mild	0.004	- 0.006; 0.014	0.416	0.015	- 0.007; 0.037	0.172	- 0.033	- 0.071; 0.004	0.080
High	0.024	0.007; 0.040	0.006	0.007	- 0.029; 0.043	0.703	0.011	- 0.049; 0.072	0.713
Social frailty: no-low (ref.)									
Mild	- 0.001	- 0.010; 0.009	0.873	0.030	0.008; 0.051	0.007	- 0.028	- 0.070; 0.013	0.178
High	0.003	- 0.009; 0.014	0.663	0.016	- 0.011; 0.042	0.253	0.017	- 0.033; 0.066	0.508
Environmental frailty: no-low (ref.)									
Mild	0.009	0.000 – 0.018	0.049	0.007	- 0.014; 0.028	0.500	0.028	- 0.010; 0.066	0.144
High	0.017	0.005 – 0.030	0.008	0.042	0.014; 0.071	0.004	0.060	0.007; 0.113	0.026
Gender: men (ref.)									
Women	0.078	0.069; 0.086	< 0.001	0.068	0.048; 0.087	< 0.001	0.080	0.047; 0.114	< 0.001
Age: 60-69 (ref.)									
70-79	0.140	0.131; 0.149	< 0.001	0.133	0.113; 0.154	< 0.001	0.128	0.089; 0.168	< 0.001
80+	0.212	0.201; 0.222	< 0.001	0.290	0.262;0.317	< 0.001	0.302	0.248; 0.357	< 0.001
Educational level: higher education (ref.)									
Higher secondary	0.097	0.087; 0.107	< 0.001	0.080	0.053; 0.106	< 0.001	0.116	0.061; 0.170	< 0.001
Lower secondary	0.205	0.195; 0.215	< 0.001	0.182	0.156; 0.208	< 0.001	0.162	0.110; 0.214	< 0.001
No degree or primary education	0.304	0.293; 0.315	< 0.001	0.279	0.250; 0.308	< 0.001	0.340	0.272; 0.408	< 0.001
Income: ≥ €2000 (ref.)									
€1500 - €1999	0.068	0.058; 0.078	< 0.001	0.116	0.093; 0.139	< 0.001	0.039	- 0.005; 0.083	0.084
€1000 - €1499	0.120	0.109; 0.131	< 0.001	0.222	0.197; 0.247	< 0.001	0.131	0.076; 0.185	< 0.001
≤ €999	0.141	0.129; 0.153	< 0.001	0.263	0.230; 0.297	< 0.001	0.239	0.140; 0.339	< 0.001
Marital status: married (ref.)									
Never married	0.025	0.002; 0.047	0.032	0.022	- 0.028; 0.072	0.382	0.114	0.026; 0.202	0.011
Divorced	- 0.022	- 0.043; - 0.001	0.045	- 0.083	- 0.123; - 0.042	< 0.001	- 0.043	- 0.106; 0.019	0.174
Cohabiting	- 0.033	- 0.063; - 0.004	0.025	- 0.043	- 0.106; 0.020	0.184	0.034	- 0.090; 0.157	0.592
Widowed	0.036	0.022; 0.050	< 0.001	- 0.002	- 0.031; 0.027	0.898	0.020	- 0.029; 0.068	0.425
Pseudo R2 (Nagelkerke)	0.396			0.357			0.372		
−2 Log Likelihood (p-value)	28240.9 (< 0.001)			8743.3 (< 0.001)			1758.0 (< 0.001)		
Correct: non-users	91.0%			73.1%			46.5%		
Correct: users	51.8%			72.8%			92.8%		
Correct: total	80.1%			73.0%			80.8%		