

Research Article

Predictors, Types of Internet Use, and the Psychological Well-Being of Older Adults: A Comprehensive Model

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Abstract

Objectives: This study aims to evaluate a comprehensive model that includes predictors of use, types of Internet use, and psychological well-being outcomes in the older population.

Methods: The total sample comprised 650 older Internet users. Structural equation modeling was used to estimate the effect of predictors (i.e., effort expectancy, performance expectancy, social influence, and ageism) on types of Internet use (i.e., information seeking, communication, instrumental use, and leisure) and the impact of the type of use on the psychological well-being of older adults (i.e., depressive and anxious symptomatology). In addition, the indirect effect of different types of Internet use was evaluated, that is, they were considered as mediator variables.

Results: Effort expectancy, social influence, and ageism predicted different types of Internet use. The relationship between effort expectancy and anxious symptomatology had an indirect effect via information seeking, whereas the relationship between ageism and anxious symptomatology showed an indirect effect via leisure.

Discussion: The findings support the importance of differentiating the types of Internet use to understand its impact on psychological well-being. Information seeking is associated with anxious symptomatology and is predicted by effort expectancy. On the contrary, leisure is crucial because of its relationship with anxious symptomatology, and less ageism can promote it. This information is useful for developing effective interventions that promote the well-being of older adults through the Internet, including strategies to cope with some online challenges that could lead to negative consequences, such as information overload.

Keywords: Anxiety, Depression, Internet, Older adults, Technology, Well-being

Information and communication technology (ICT) use is higher in younger age groups than in the older population. However, there is a growing motivation for ICT use in people 60 years or older (considered an older person; Ivan, 2019). Thus, the age differences in the use of technologies are narrowing, making it relevant to study this topic in the older population (Klimova et al., 2016), especially from a psychological perspective (Wagner et al., 2010).

Some of the reported benefits of technology use by older adults include reduction of depressive symptoms and suicidal ideation (Jun & Kim, 2017; Wang et al., 2019) and increase in life satisfaction (Lifshitz et al., 2018). In the social domain, ICT use favors social connectivity (Berg et al., 2017; Chen & Schulz, 2016; Forsman & Nordmyr, 2017; Szabo et al., 2019), access to community resources (Forsman & Nordmyr, 2017), participation (Ihm & Hsieh,

2015), and social inclusion (Forsman & Nordmyr, 2017). Furthermore, it reduces feelings of loneliness, promoting psychological well-being (P. F. Chang et al., 2015; Heo et al., 2015; Szabo et al., 2019).

In contrast, Elliot et al. (2014) found no significant influence of ICT use on the psychological well-being of older people. However, it was observed that ICT use acted as a moderating variable, as limitations in daily living activities were associated with a higher level of depressive symptomatology in older adults with a high level of ICT use. In contrast, the illness level was a significant predictor of depressive symptomatology among those with low or no ICT use.

Types of Internet Use and Its Impact on the Well-Being of Older Adults

In several studies, the assessment of Internet use is not very detailed. It is frequently based either on the number of devices used or by measuring whether the person uses the Internet in a dichotomous manner (e.g., yes or no). However, the literature recognizes the importance of assessing Internet use in research about older adults. Some of the most common types of Internet use among older adults are (a) information seeking/education (e.g., health information seeking); (b) communication and social support (e.g., contact with family and friends); (c) instrumental use, productivity, or task performance (e.g., conducting bank transactions or online shopping); and (d) leisure and entertainment (e.g., gaming, virtual hobbies, movies or series, and cognitive stimulation; Lifshitz et al., 2018; Szabo et al., 2019; Wagner et al., 2010).

According to research, the influence of ICT on the well-being of older individuals varies depending on the types or function of use (i.e., the purpose for which the technology is used; Ihm & Hsieh, 2015; Lifshitz et al., 2018; Sims et al., 2017; Szabo et al., 2019). This highlights the importance of including this distinction to avoid broad generalizations about the relationship of ICT use and well-being in older groups (Lifshitz et al., 2018).

Lifshitz et al. (2018) observed that after adjusting for sociodemographic variables, only the leisure and entertainment function displayed a significant association with older adults' psychological well-being. Furthermore, Sims et al. (2017) described that communication motivation is associated with greater psychological well-being but not physical well-being. In contrast, information seeking affected physical but not psychological well-being in people 80 years and older.

Szabo et al. (2019) conducted a longitudinal study with people aged from 60 to 77 years. They found that social use indirectly affects well-being through decreased loneliness and increased social engagement. In turn, informational and instrumental applications indirectly favored well-being through participation. This is consistent with findings reported by Lam et al. (2020), who conducted a longitudinal

study assessing the impact of the frequency and purpose of Internet use on older adults' mental health. The results indicated that Internet use for communication leads to less depressive symptomatology and greater life satisfaction. However, those who used the Internet for information seeking reported lower life satisfaction than those who did not.

In order to have a detailed understanding of the effects of ICT use on older adults' well-being, it is necessary to consider predictors of Internet use in this age group. Thus, it will be possible to develop comprehensive models that incorporate predictors of use, types of use, and psychological well-being outcomes.

Predictors of Internet Use Among the Older Population

There are indications that some sociodemographic aspects affect using technology by older adults. Thus, people who are younger and have a higher educational level use more ICT (J. Chang et al., 2015; Elliot et al., 2014; Gell et al., 2015; Heart & Kalderon, 2013; Vroman et al., 2015; Wagner et al., 2010).

Many predictors of ICT use are based on models generated to assess different populations but not specifically this age group. One of these is the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003), which posits that technology use is influenced by performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is related to perceived usefulness, that is, the technology as a facilitator of the achievement of goals; effort expectancy is the perceived ease of technology use; social influence is the impact of the environment on the decision to use ICT, and facilitating conditions refer to the degree to which the individual believes that the existing infrastructure supports technology use.

Macedo (2017) explored the relevance of this theory to understand ICT use in the older population using the UTAUT2, which modifies the UTAUT by adding certain variables (i.e., hedonic motivation, the cost of technology, and habit). However, specific variables related to gerontology were not included. The results revealed that performance expectancy, effort expectancy, facilitating conditions, hedonic motivations, and habits were significantly and positively associated with the intention of ICT use.

These findings are consistent with a meta-analysis that evaluated the main variables influencing ICT use in older adults (Zhou et al., 2020). Aspects such as performance expectancy, perceived usefulness, effort expectancy, perceived ease of use, technical performance, facilitating conditions, and social influence were positively associated with the user's behavioral intention to use ICT.

However, a limitation of utilizing general technology use prediction models, such as the UTAUT, is that they were not designed to study older individuals. Thus, it is necessary

to include predictor variables that could influence ICT use in this particular age group. One of these variables is ageism, conceptualized as stereotypes and prejudices based on age. Ageism is a complex issue and affects discrimination against older individuals because of their age (Butler, 1969). Ageism includes the affective (prejudice) and cognitive (stereotype) component, which influences the behavioral dimension (discrimination; Cuddy & Fiske, 2002). These ageist ideas are internalized across the life span and operate unconsciously, challenging its recognition (Levy, 2009). Some of the most common prejudices and stereotypes consider older adults incompetent, cognitively impaired, lonely, weak, and less responsible than younger people (Cuddy & Fiske, 2002). Also, ageism produces the fear of confirming the ageist ideas in the older population (stereotype threat), interfering with their self-efficacy (Mariano et al., 2020).

Although there is insufficient information regarding the association of ageism and ICT use in the older population, there is extensive evidence of its impact on the well-being of this age group (E. S. Chang et al., 2020), for instance, in the decline of physical health, social contact, cognitive skills, and psychological well-being (Han, 2018; Robertson, 2017; Robertson & Kenny, 2016). In the specific assessment of the relationship between self-perceptions of aging (SPA) and ICT use, a significant lagged effect between ICT use and SPA was observed in a longitudinal study (Kottl et al., 2020), indicating that greater technology use favors a more positive view of aging. However, the lagged effect between SPA and ICT use was not significant. Despite not confirming their initial hypothesis, the authors highlight the importance of generating campaigns to eradicate ageism concerning ICT use (Kottl et al., 2020). In addition, Mariano et al. (2020) reported that stereotype threat reduces computer adoption by older adults.

The Current Study

It is possible to identify two lines of research that address the issue of Internet use in the older population in a disaggregated way: those that focus on the relationship between predictors of ICT use (e.g., J. Chang et al., 2015; Heart & Calderon, 2013; Macedo, 2017) and those that address the relationship between ICT use and the well-being of older individuals (e.g., Lam et al., 2020; Lifshitz et al., 2018; Sims et al., 2017). However, only a few studies include a comprehensive model that incorporates both predictors of use related to technology adoption and the impact of use on older adults' psychological well-being (e.g., Elliot et al., 2014). Furthermore, those models have not included aspects of technology use acceptance that have been widely studied as predictor variables (e.g., UTAUT).

Moreover, although existing models have progressed in describing predictor variables of technology use, it is essential to adapt them to the older population's reality, including relevant aspects for this age group's well-being, such as ageism. We hypothesize that these conceptions

affect older persons' relationship with technology when it is assumed that, because of their age, they cannot learn (Cutler, 2005). Although Kottl et al. (2020) did not find a lagged effect between SPA and everyday ICT engagement, this model did not differentiate types of technology use as proposed in this work.

The present study aims to explore the association between ICT use and the psychological well-being of older adults using a comprehensive model that considers the particularities of this age group. For this purpose, predictor variables of ICT use, the different functions of ICT use, and the two dimensions of psychological well-being (i.e., depressive symptomatology and anxious symptomatology) will be considered. This comprehensive model will contribute to assessing the indirect effect between predictors of Internet use and psychological well-being through the types of Internet use that were considered as mediator variables. This will enable the collection of detailed information on which pathways favor psychological well-being in older individuals. Consequently, it will be possible to develop more effective interventions about Internet use to promote the well-being of this age group.

To our knowledge, this is the first study that incorporates this type of comprehensive model. The novelty also lies in applying this type of model to the specific demographic and cultural context of Latin America.

Method

Sample and Procedures

The sample comprised 671 older adults aged 60 and older. A temporal orientation question was used as an exclusion criterion because it proved to be a sensitive cognitive decline indicator (i.e., "Please, indicate the date you are answering this questionnaire"; O'Keeffe et al., 2011). Thus, people who did not answer correctly or omitted this question were excluded ($n = 21$). The final sample comprised 650 participants.

Participants were recruited through a post in social media networks, particularly Facebook, linked to an online survey. People 60 years or more living in Chile were invited to complete the online questionnaire voluntarily during the first semester of 2020 (i.e., though the study did not focus on the coronavirus disease 2019 [COVID-19] pandemic, data collection was conducted in this context; see Discussion section). All the respondents agreed to participate through informed consent approved by the Institutional Ethics Committee (Scientific Ethical Committee in Social Sciences, Arts and Humanities).

Measures

Predictors of technology use by the UTAUT

Three dimensions of UTAUT (Venkatesh et al., 2003) were selected, which are the most crucial in technology adoption (Khechine et al., 2016): performance expectancy

(e.g., “I find the Internet useful in my daily life”), effort expectancy (e.g., “Learning how to use the Internet is easy for me”), and social influence (e.g., “People who are important to me think that I should use the Internet”). The response format was a 7-point Likert scale ranging from “strongly disagree” to “strongly agree.” This scoring means that those who believe that the Internet is helpful in daily life (i.e., performance expectancy), perceive the Internet as easy to use (i.e., effort expectancy), and notice more social influence for Internet use report higher scores in each subscale. The original version for the list of items was written in English; however, a translation has been used to evaluate the Chilean population, indicating good reliability with a Cronbach’s alpha over 0.91 in all subscales (Ramírez-Correa et al., 2017). The items used were based on this translation and were adapted considering the original language version and the purpose of the study (e.g., using the word “Internet” instead of “mobile Internet”).

Ageism

The revised version of the Questionnaire on Negative Stereotypes about Old Age (Cuestionario de Estereotipos Negativos hacia la Vejez) was used (Rosell et al., 2020). This revised version was adapted from Blanca Mena et al. (2005) and Fernández-Ballesteros (1992). The instrument comprises 15 items with a Likert scale format from 1 (*strongly disagree*) to 4 (*strongly agree*). The questionnaire has a unidimensional structure and includes questions about ageism in the cognitive, social, and personality domains (e.g., “The vast majority of people

60 years old or older get angry easily and are grumpy”). The Chilean validation showed good reliability, including a 0.92 omega.

Types of Internet use

There were 16 questions on the number of days a person uses the Internet every month based on the four most frequent types of Internet use: information seeking, communication, productivity/instrumental use, and leisure/entertainment. The response format considers six options that divide the 30 days of a month into ranges of 5 days (e.g., “1 to 5 days,” “6 to 10 days”). Additionally, the option “never” was added. Due to the dispersion of responses, we merged “1 to 5 days” with “6 to 10 days,” “11 to 15 days” with “16 to 20 days,” and “21 to 25 days” with “26 to 30 days” to conduct the analysis.

Depressive symptomatology

The abbreviated Geriatric Depression Scale measured depressive symptomatology (Brink et al., 2008). It consists of five “yes” or “no” response items (e.g., “Do you feel basically satisfied with your life?”). Higher scores indicate higher levels of depressive symptomatology. It was validated in Chile with a sensitivity of 0.88 and specificity of 0.90 in diagnosing depression (Hoyl et al., 2000).

Anxious symptomatology

The Geriatric Anxiety Inventory (Pachana et al., 2007) measured anxious symptomatology and was validated in Chile with a sample of older adults (Miranda-Castillo et al., 2019). The instrument assesses anxious symptomatology

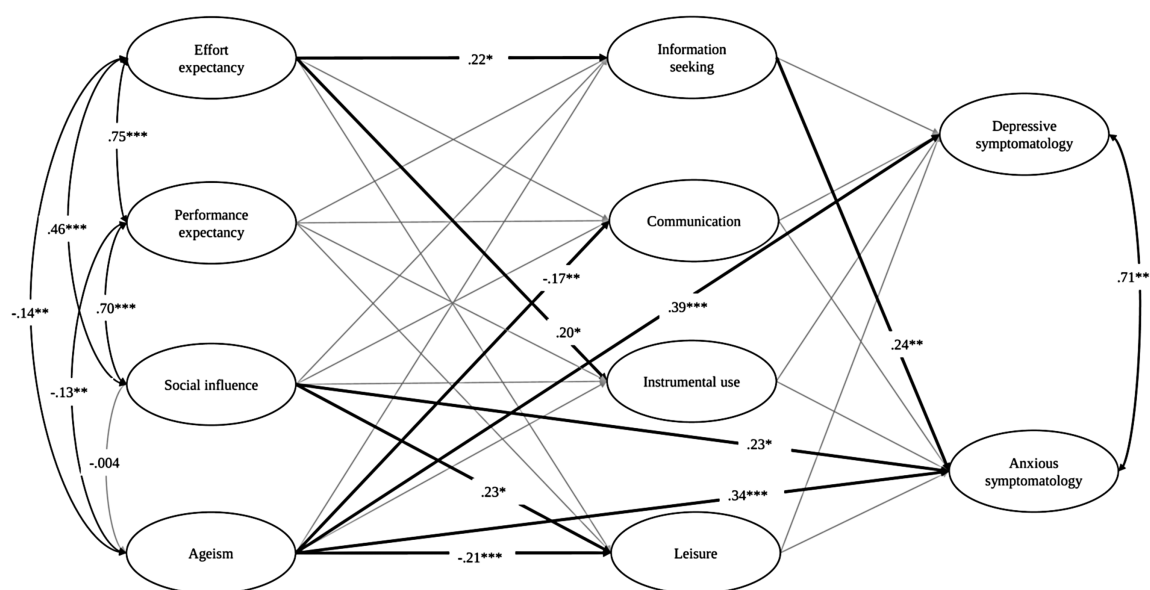


Figure 1. Path standardized coefficients of the structural equation model. Notes: * $p < .05$, ** $p < .01$, *** $p < .001$. Correlations among types of Internet use: information seeking with communication = 0.56***; information seeking with instrumental use = 0.31***; information seeking with leisure = 0.41***; communication with instrumental use = 0.52***; communication with leisure = 0.23***; instrumental use with leisure = 0.43***. Standardized coefficients between covariates, types of Internet use, and psychological well-being are reported separately. No significant paths from predictors to psychological well-being outcomes were added.

Table 1. Correlation Matrix of the Latent Variables in the Measurement Model

	1	2	3	4	5	6	7	8	9	10
1. Effort	0.96									
2. Performance	0.75***	0.90								
3. Social	0.46***	0.70***	0.94							
4. Ageism	-0.14**	-0.13**	-0.004	0.93						
5. Information	0.33***	0.31***	0.23***	-0.14**	0.79					
6. Communication	0.33***	0.38***	0.29***	-0.23***	0.61***	0.68				
7. Instrumental use	0.37***	0.36***	0.26***	-0.14**	0.41***	0.60***	0.69			
8. Leisure	0.27***	0.35***	0.34***	-0.23***	0.47***	0.53***	0.33***	0.65		
9. Depression	-0.10	-0.07	-0.005	0.47***	-0.14*	-0.32***	-0.23	-0.22**	0.86	
10. Anxiety	-0.07	-0.06	0.08	0.41***	0.02**	-0.17**	-0.15**	-0.17**	0.75***	0.97

Notes: Anxiety = anxious symptomatology; Depression = depressive symptomatology; Effort = effort expectancy; Information = information seeking; Perform = performance expectancy; Social = social influence. The diagonal is the Cronbach's alpha for each scale used.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2. Standardized Coefficients Between Covariates, Types of Internet Use, and Psychological Well-Being Outcomes

	Age	Gender	Educational level
Types of Internet use			
Information seeking	0.004	0.08	0.07
Communication	-0.01	-0.06	0.08
Instrumental use	0.01	-0.04	0.24***
Leisure	-0.08	-0.02	-0.04
Psychological well-being			
Depression	-0.04	-0.06	-0.16*
Anxiety	-0.14**	-0.06	-0.04

Notes: Anxiety = anxious symptomatology; Depression = depressive symptomatology.

* $p < .05$. ** $p < .01$. *** $p < .001$.

with 20 statements comprising a “yes” or “no” answer (e.g., “I spend a lot of time worrying”). Higher scores indicate higher levels of anxious symptomatology. In the Chilean validation, the global scale presented good reliability with a Cronbach's alpha of 0.93.

Finally, participants provided sociodemographic information such as age, gender, and educational level.

Data Analysis

A structural equation modeling (SEM) analysis was used to evaluate the relationship among variables considering the direct and indirect effects of the predictor variables (i.e., effort expectancy, performance expectancy, social influence, and ageism) on the psychological well-being outcomes (i.e., depressive symptomatology and anxious symptomatology) through different types of Internet use (i.e., information seeking, communication, productivity, and leisure), which were considered as mediators (see Figure 1). Additionally, sociodemographic characteristics (i.e., age, gender, and educational level) were included as covariates in the model.

The WLSMV estimator was used because all the items were categorical, except for the covariates. The bootstrap technique with 2,000 replications was used to estimate the indirect effects' asymmetric confidence intervals (CIs), with $p < .05$ as the threshold for statistical significance.

A two-step procedure was used to evaluate the model fit (Anderson & Gerbing, 1988). First, the measurement model was fitted to establish the observed item's loadings for each latent factor. Then, the full SEM was performed to evaluate the model fit. Thus, conventional cutoff values were considered indicators of a good fit: 0.95 and more for comparative fit index (CFI) and Tucker–Lewis index (TLI), equal or below 0.06 for root mean square error of approximation (RMSEA) and 0.08 for standardized root mean square residual (SRMR) (Hu & Bentler, 1999).

The analyses were carried out using Mplus 8 (Muthén & Muthén, 2017).

Results

Sample Characteristics

The mean age was 66.57 ranging from 60 to 82; 87% were females; 18.6% had cleared elementary or high school, 22.2% had technician degrees (practical/vocational title), 14.5% had an incomplete bachelor's degree, 35.1% had a bachelor's degree, and 9.5% had a master's degree or a PhD.

Measurement Model

The measurement model fit the data adequately: $\chi^2(1970) = 2,974.48$, $p < .001$, CFI = 0.97, TLI = 0.97, RMSEA = 0.028 (95% CI [0.026, 0.03]), SRMR = 0.068. In addition, all the factor loadings displayed values over 0.5 and were statistically significant. The exception was item 3 of the questionnaire about ageism ($\lambda = 0.36$, $p < .001$); however, it was retained in the analysis because of the importance of its content (i.e., the stereotype about older persons' sexuality) and its statistical significance. Table 1

Table 3. Total Indirect Effect and Indirect Effect of the Model Relationships

Model path	Estimate	95% CI
Total indirect effect		
Effort → Depression	−0.006	−0.09, 0.11
Perform → Depression	−0.06	−0.2, 0.03
Social → Depression	−0.03	−0.12, 0.05
Ageism → Depression	0.05	−0.007, 0.13
Effort → Anxiety	0.02	−0.06, 0.11
Perform → Anxiety	−0.04	−0.15, 0.05
Social → Anxiety	−0.03	−0.12, 0.04
Ageism → Anxiety	0.04	−0.01, 0.09
Indirect effect		
Effort → Information seeking → Depression	0.02	−0.02, 0.11
Effort → Communication → Depression	−0.02	−0.1, 0.05
Effort → Instrumental use → Depression	−0.008	−0.07, 0.06
Effort → Leisure → Depression	−0.003	−0.04, 0.02
Perform → Information seeking → Depression	0.007	−0.05, 0.07
Perform → Communication → Depression	−0.06	−0.21, 0.02
Perform → Instrumental use → Depression	−0.004	−0.06, 0.05
Perform → Leisure → Depression	−0.01	−0.08, 0.03
Social → Information seeking → Depression	0.009	−0.02, 0.07
Social → Communication → Depression	−0.02	−0.12, 0.03
Social → Instrumental use → Depression	−0.003	−0.05, 0.04
Social → Leisure → Depression	−0.02	−0.09, 0.04
Ageism → Information seeking → Depression	−0.009	−0.04, 0.009
Ageism → Communication → Depression	0.04	−0.01, 0.12
Ageism → Instrumental use → Depression	0.002	−0.02, 0.03
Ageism → Leisure → Depression	0.02	−0.03, 0.07
Effort → Information seeking → Anxiety	0.05	0.007, 0.13
Effort → Communication → Anxiety	−0.01	−0.07, 0.04
Effort → Instrumental use → Anxiety	−0.01	−0.08, 0.02
Effort → Leisure → Anxiety	−0.007	−0.05, 0.03
Perform → Information seeking → Anxiety	0.02	−0.06, 0.1
Perform → Communication → Anxiety	−0.03	−0.13, 0.04
Perform → Instrumental use → Anxiety	−0.007	−0.06, 0.03
Perform → Leisure → Anxiety	−0.02	−0.09, 0.02
Social influence → Information seeking → Anxiety	0.02	−0.03, 0.08
Social → Communication → Anxiety	−0.01	−0.08, 0.03
Social → Instrumental use → Anxiety	−0.006	−0.05, 0.02
Social → Leisure → Anxiety	−0.04	−0.19, 0
Ageism → Information seeking → Anxiety	−0.02	−0.06, 0
Ageism → Communication → Anxiety	0.02	−0.03, 0.08
Ageism → Instrumental use → Anxiety	0.003	−0.02, 0.02
Ageism → Leisure → Anxiety	0.03	0.002, 0.08

Notes: Anxiety = anxious symptomatology; CI = confidence interval; Depression = depressive symptomatology; Effort = effort expectancy; Perform = performance expectancy; Social = social influence.

summarizes the correlations among the latent factors. The full SEM was evaluated by considering these results.

Full Structural Model

The full structural model included all the factors of the measurement model and the covariates of age, gender, and educational level. The model displayed a good fit to the

data $\chi^2(2135) = 3,192.72, p < .001$, CFI = 0.97, TLI = 0.97, RMSEA = 0.028 (95% CI [0.026, 0.03]), SRMR = 0.067.

Figure 1 illustrates the standardized path coefficients of the model, correlations among the predictors of Internet use, and the correlation between the outcomes of psychological well-being. The standardized coefficients between the covariates, Internet type of use, and psychological well-being are summarized in Table 2.

The results revealed a direct effect of effort expectancy on information seeking ($\beta = 0.22, p = .02$). No other predictors were significant for this type of use. In the case of the use for communication purposes, only ageism presented a significant and negative association as a predictor of use ($\beta = -0.17, p = .004$). Only effort expectancy presented a significant and positive association ($\beta = 0.2, p = .04$) with the use of the Internet for instrumental purposes. Regarding Internet use for leisure, social influence revealed a significant and positive relationship ($\beta = 0.23, p = .02$), whereas ageism presented a significant and negative association ($\beta = -0.21, p < .001$). The effort expectancy and performance expectancy indicated no significant association with leisure use.

Regarding the direct effects between Internet use predictors and the outcomes of psychological well-being (i.e., depressive and anxious symptomatology), the social influence for using technology proved to be significantly and positively related to anxious symptomatology ($\beta = 0.23, p = .02$). Additionally, ageism displayed a significant and positive association with depressive symptomatology ($\beta = 0.39, p < .001$) and anxious symptomatology ($\beta = 0.34, p < .001$). No other path was significant for depressive symptomatology.

Concerning the direct effects between types of Internet use and psychological well-being outcomes, only the information-seeking purpose presented a significant association with anxious symptomatology ($\beta = 0.23, p = .007$).

The total and specific indirect effects are presented in Table 3. The significant pathways were the effect of effort expectancy on anxious symptomatology via information seeking ($\beta = 0.05, 95\% \text{ CI } [0.007, 0.13]$), and ageism on anxious symptomatology via leisure ($\beta = 0.03, 95\% \text{ CI } [0.002, 0.081]$). Furthermore, the pathway of social influence on anxious symptomatology via leisure was almost significant ($\beta = -0.04, 95\% \text{ CI } [-0.108, 0]$). The same was true for the effect of ageism on anxious symptomatology via information seeking ($\beta = -0.02, 95\% \text{ CI } [-0.059, 0]$). In the case of depressive symptomatology, no indirect effect was significant.

The variances of the psychological well-being outcomes accounted for by the model were 31% for depressive symptomatology and 25.5% for anxious symptomatology.

Discussion

The present study contributes to understanding the impact of Internet use on the psychological well-being of older adults. To our knowledge, this is the first study to include predictors like ageism (a relevant variable from a gerontological perspective) combined with those widely tested in the literature (i.e., UTAUT), and the differentiation of types of Internet use to understand the impact on psychological well-being. Additionally, the specific pathways from predictors of use on psychological well-being via types of use were evaluated.

The results confirmed the importance of differentiating the type of Internet use to understand the process that affects older adults' psychological well-being. Many studies assessed whether the person is an Internet user and the general frequency of use. However, differentiating among types of use is relevant because different effects are observed for each of them (Ihm & Hsieh, 2015; Lifshitz et al., 2018; Sims et al., 2017; Szabo et al., 2019).

Regarding predictors of Internet use, it was hypothesized that ageism significantly influences the acceptance, type, and frequency of Internet use. Results indicated that ageism is especially relevant as a predictor of Internet use for communication and leisure, with lower levels of ageism linked to a higher frequency of these uses. Other authors explain the influence of ageism considering the stereotype threat (i.e., the fear of confirming ageist ideas) as a factor that reduces computer adoption in the older population (Mariano et al., 2020). However, to our knowledge, this is the first study to include ageism as a predictor when differentiating types of Internet use.

Furthermore, effort expectancy (i.e., self-efficacy for Internet use) was associated with Internet use for information seeking and instrumental use. Those who perceive the Internet as easy to use reported a higher frequency of Internet use for information seeking and instrumental use. Previous literature has revealed that self-efficacy (i.e., the perception of being capable of using the Internet) favors Internet use in general (Macedo, 2017; Zhou et al., 2020), and our results contribute to distinguishing specific effects by differentiating the types of use.

Additionally, social influence was associated with the less frequent type of use: E-leisure (i.e., online leisure; Vroman et al., 2015). Previous evidence indicates that social influence improves the acceptance and use of ICT among older people (Macedo, 2017). Our findings are consistent because those with greater social influence reported a higher frequency of E-leisure. This outcome could be interpreted as an increased social incentive to engage in more complex online activities and, in turn, more social support to become involved in them.

Conversely, performance expectancy was not directly associated with any type of Internet use. This finding is not consistent with previous evidence (e.g., Macedo, 2017), which may be because we distinguished the types of Internet use and included ageism as a predictor along with dimensions of the UTAUT. In this way, our results partially confirm the pertinence of the main dimensions UTAUT/UTAUT2 in the older population, and further research should revise especially performance expectancy.

To understand the direct relationship between Internet use and psychological well-being outcomes, we need to consider the indirect effect via types of Internet use. Information seeking plays a relevant role in the case of anxious symptomatology. Those who believe that the Internet is difficult to use (i.e., effort expectancy) or have higher levels of ageism reported a lower frequency of information

seeking, associated with lower anxious symptomatology. On the contrary, people with more effort expectancy or less ageism use the Internet for information seeking and, in turn, are associated with higher anxious symptomatology.

At this point, it could be argued that older people with specific characteristics (e.g., health problems) may use the Internet more frequently for information seeking. Nevertheless, disability situations have a less negative impact on the well-being of older people when they are users of social networking sites, illustrating the role of Internet use in coping with health problems (van Ingen et al., 2017). However, the information overload from seeking information on the Internet can reduce psychological well-being (Swar et al., 2017). Consequently, the key is to educate older people to deal with overwhelming online information (e.g., source verification strategies to avoid fake news).

Also, the study was conducted during the COVID-19 pandemic when people were more exposed to false, contradictory, or negative information on the Internet. Previous research found that using social media for information seeking related to COVID-19 correlates with more anxiety symptoms in older individuals (Wong et al., 2021). The pandemic appears to impose a hostile environment, leaving the Internet users, especially the older ones, with fewer coping mechanisms to deal with the adverse effects of Internet use (Nimrod, 2020b). Thus, it is necessary to assess whether our results can be extrapolated to the nonpandemic period. However, research carried out before the pandemic found that Internet use for information seeking was associated with lower life satisfaction in the older population (Lam et al., 2020), pointing to the possibility that this association transcends the pandemic context.

On the other hand, recreational Internet use (i.e., leisure and entertainment) was related to anxious symptomatology. Those with a higher social influence for Internet use or less ageism reported higher leisure through the Internet and less anxious symptomatology. Conversely, when the social environment does not influence Internet use, or there are high levels of ageism, less E-leisure is reported, and, in turn, more anxious symptomatology is observed. These findings are consistent with studies demonstrating the relevance of social influence for technology adoption (Barrantes Cáceres & Cozzubo Chaparro, 2017; Chu, 2010), the importance of reducing ageism to promoting E-leisure (Rosell & Vergés, 2021), and the role of E-leisure to improve the quality of life of older adults (Lifshitz et al., 2018; Nimrod, 2020a).

These results indicate that Internet use can be beneficial as a coping strategy in times of crisis (such as the pandemic), promoting the psychological well-being of the older population. However, not all uses of the Internet are effective for this purpose. Our findings suggest a crucial role of E-leisure, which is consistent with other studies that demonstrate that only Internet use for leisure is associated with the enhanced well-being of older adults in the context of the COVID-19 pandemic (Nimrod, 2020a). This

link was also observed in the prepandemic context. Lifshitz et al. (2018) reported that only E-leisure presented a significant association with older adults' psychological well-being after adjusting for sociodemographic variables.

The different types of Internet use did not reveal a direct relationship or an indirect effect concerning depressive symptomatology. These results are consistent with Elliot et al. (2014) report, which did not find an impact of technology use on depressive symptomatology, which was evaluated using an SEM. Nevertheless, longitudinal studies indicated that Internet use decreases depressive symptomatology, primarily through communication and the enhancement of social networks (Jun & Kim, 2017; Lam et al., 2020). However, it is necessary to assess whether these results are consistent when including other predictors of Internet use in the model, such as ageism or those proposed by the UTAUT.

Implications

Ageism is associated with Internet use and the psychological well-being of older people. The stereotype threat undermines computer adoption by older adults and hinders the digital inclusion of the older population (Mariano et al., 2020). It is imperative to generate interventions to eradicate ageism, particularly with regard to ICT use (Kortl et al., 2020).

Specifically, ageism has revealed a direct and negative relationship with both psychological well-being outcomes. Also, there is extensive evidence of its impact on older adults' well-being (E. S. Chang et al., 2020). For this reason, it is a relevant variable to include in future longitudinal studies.

Furthermore, public policies, programs, and strategies are required to educate people to filter the huge amount of online information available while considering the specific characteristics of the older population. This approach could enhance the benefits of Internet use and decrease its negative impact, such as anxious symptomatology.

Additionally, Internet use for leisure needs to be promoted, for example, through massive campaigns, programs for digital inclusion, and the enhancement of intergenerational contact. Thus, E-leisure could be an effective coping strategy in the context of crises such as pandemics.

It is also imperative to consider the characteristics of the Latin American region when interpreting these results, as most of the existing evidence comes from North America, Europe, and Asia (e.g., China and Japan). In the case of Latin America, Internet access has increased, but there are still broad differences depending on the area of residence and the income level of the families. Thus, those living in rural areas still have deficiencies in Internet access (Rojas et al., 2016). Hence, beyond interventions targeting psychosocial variables to promote Internet use, it is also necessary to increase its access (e.g., in public spaces).

Chile is one of the countries with the highest Internet access in the region (Rojas et al., 2016). However, the

country's social protection system has failed to eliminate poverty in the older population. Internet access is not a priority in this context. Eighteen percent of households where only older people live reported that the cost is very high and that it is the main reason for not paying for Internet access. Only 54.6% of this type of household have Internet access, in contrast to 94% in families with children (Subsecretaría de Telecomunicaciones de Chile, 2017). Also, another reason for not using the Internet is not knowing how to use a computer or smartphone (19.2%; Subsecretaría de Telecomunicaciones de Chile, 2017), which could be overcome by social influence showing the relevance of its use.

These results need to be interpreted in light of a few limitations. For instance, the sample composition, with a highly educated and young sample (i.e., with an average age below 70 years) that is not representative of the overall population (thus, affecting the generalizability of the findings) but is likely more representative of Internet users. This bias was caused by the pandemic context that prevented reaching non-Internet users with a face-to-face strategy.

Furthermore, the cross-sectional design precludes establishing causality or temporal ordering of variables of the model, although previous longitudinal studies indicate an impact of Internet use on the psychological well-being of older adults (Lam et al., 2020; Szabo et al., 2019). Finally, all variables were measured through self-report and, thus, are subject to recall bias. This issue is crucial given the evidence of measurement error in self-reported Internet use (Burnell et al., 2021).

It is important to note that the pandemic leads to distress in the population, and some demographic variables could affect Internet use within this stressful context. For instance, family support or the number of people living in the household can influence predictor variables such as performance expectation or social influence. It is known that social capital, understood as relationships and resources, increases the probability of Internet use in the older population (Barbosa Neves et al., 2018). Future research should explore these kinds of sociodemographic variables and their relationship with the predictors presented here.

Also, future studies should explore this topic considering a longitudinal design. The indirect effects found are consistent with mediation, which should be assessed longitudinally. Particular attention should be given to including relevant variables according to these results, for example, ageism. In addition, E-leisure needs to be further explored as a helpful type of Internet use for improving the psychological well-being of older people. Moreover, direct measurement of Internet use should be acquired whenever possible. Finally, we measured only two dimensions of psychological well-being (i.e., depressive and anxious symptomatology). Future research should include other aspects (such as loneliness, resilience, or life satisfaction), understanding that psychological well-being is a broad construct.

Conclusion

The current study has proposed a comprehensive association model of predictors of Internet use, type of use, and psychological well-being. Our findings highlight the importance of ageism and the need to distinguish types of Internet use in future research.

Particular attention should be paid to Internet use for information seeking due to its potential role in increasing anxious symptomatology. On the contrary, E-leisure might play a role in improving the psychological well-being of older adults, mainly through the reduction of anxious symptomatology. Thus, interventions should consider the different types of Internet use to enhance their benefits in the older population.

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Conflict of Interest

None declared.

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This study was not preregistered.

Data Availability

These data can be made available upon request and in accordance with applicable laws. For further information about the accessibility of the data, please contact jerosell@uc.cl.

References

- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411–423. doi:10.1037/0033-2909.103.3.411
- Barbosa Neves, B., Fonseca, J. R. S., Amaro, F., & Pasqualotti, A. (2018). Social capital and Internet use in an age-comparative perspective with a focus on later life. *PLoS One*, 13(2), e0192119. doi:10.1371/journal.pone.0192119
- Barrantes Cáceres, R., & Cozzubo Chaparro, A. (2017). Age for learning, age for teaching: The role of inter-generational, intra-household learning in Internet use by older adults in Latin America. *Information, Communication & Society*, 22(2), 250–266. doi:10.1080/1369118x.2017.1371785

- Berg, T., Winterton, R., Petersen, M., & Warburton, J. (2017). 'Although we're isolated, we're not really isolated': The value of information and communication technology for older people in rural Australia. *Australasian Journal on Ageing*, 36(4), 313–317. doi:10.1111/ajag.12449
- Blanca Mena, M. J., Sánchez Palacios, C., & Trianes, M. (2005). Cuestionario de evaluación de estereotipos negativos hacia la vejez. *Revista Multidisciplinar de Gerontología*, 15(4), 212–220.
- Brink, T. L., Yesavage, J. A., Lum, O., Heersema, P. H., Adey, M., & Rose, T. L. (2008). Screening tests for geriatric depression. *Clinical Gerontologist*, 1(1), 37–43. doi:10.1300/J018v01n01_06
- Burnell, K., George, M. J., Kurup, A. R., Underwood, M. K., & Ackerman, R. A. (2021). Associations between self-reports and device-reports of social networking site use: An application of the truth and bias model. *Communication Methods and Measures*, 15(2), 156–163. doi:10.1080/19312458.2021.1918654
- Butler, R. N. (1969). Age-ism: Another form of bigotry. *The Gerontologist*, 9(4), 243–246. doi:10.1093/geront/9.4_part_1.243
- Chang, E. S., Kanno, S., Levy, S., Wang, S. Y., Lee, J. E., & Levy, B. R. (2020). Global reach of ageism on older persons' health: A systematic review. *PLoS One*, 15(1), e0220857. doi:10.1371/journal.pone.0220857
- Chang, J., McAllister, C., & McCaslin, R. (2015). Correlates of, and barriers to, Internet use among older adults. *Journal of Gerontological Social Work*, 58(1), 66–85. doi:10.1080/01634372.2014.913754
- Chang, P. F., Choi, Y. H., Bazarova, N. N., & Lockenhoff, C. E. (2015). Age differences in online social networking: Extending socioemotional selectivity theory to social network sites. *The Journal of Broadcasting & Electronic Media*, 59(2), 221–239. doi:10.1080/08838151.2015.1029126
- Chen, Y. R., & Schulz, P. J. (2016). The effect of information communication technology interventions on reducing social isolation in the elderly: A systematic review. *Journal of Medical Internet Research*, 18(1), e18. doi:10.2196/jmir.4596
- Chu, R. J. (2010). How family support and Internet self-efficacy influence the effects of e-learning among higher aged adults—Analyses of gender and age differences. *Computers & Education*, 55(1), 255–264. doi:10.1016/j.compedu.2010.01.011
- Cuddy, A. J. C., & Fiske, S. T. (2002). Doddering but dear: Process, content, and function in stereotyping of older persons. In T. D. Nelson (Ed.), *Ageism: Stereotyping and prejudice against older persons* (pp. 3–26). The MIT Press.
- Cutler, S. (2005). Ageism and technology. *Generations*, 29(3), 67–72. <https://www.jstor.org/stable/26555416>.
- Elliot, A. J., Mooney, C. J., Douthit, K. Z., & Lynch, M. F. (2014). Predictors of older adults' technology use and its relationship to depressive symptoms and well-being. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 69(5):667–677. doi:10.1093/geronb/gbt109
- Fernández-Ballesteros, R. (1992). *Mitos y realidades sobre la vejez y la salud*. Fundación Caja de Madrid: SG Editores.
- Forsman, A. K., & Nordmyr, J. (2017). Psychosocial links between Internet use and mental health in later life: A systematic review of quantitative and qualitative evidence. *Journal of Applied Gerontology*, 36(12), 1471–1518. doi:10.1177/0733464815595509
- Gell, N. M., Rosenberg, D. E., Demiris, G., LaCroix, A. Z., & Patel, K. V. (2015). Patterns of technology use among older adults with and without disabilities. *The Gerontologist*, 55(3), 412–421. doi:10.1093/geront/gnt166
- Han, J. (2018). Chronic illnesses and depressive symptoms among older people: Functional limitations as a mediator and self-perceptions of aging as a moderator. *Journal of Aging and Health*, 30(8), 1188–1204. doi:10.1177/0898264317711609
- Heart, T., & Kalderon, E. (2013). Older adults: Are they ready to adopt health-related ICT? *International Journal of Medical Informatics*, 82(11), e209–e231. doi:10.1016/j.ijmedinf.2011.03.002
- Heo, J., Chun, S., Lee, S., Lee, K. H., & Kim, J. (2015, May). Internet use and well-being in older adults. *Cyberpsychology, Behavior, and Social Networking*, 18(5), 268–272. doi:10.1089/cyber.2014.0549
- Hoyle, T., Valenzuela A. E., & Marín L. P. P. (2000). Depresión en el adulto mayor: Evaluación preliminar de la efectividad, como instrumento de tamizaje, de la versión de 5 ítems de la Escala de Depresión Geriátrica. *Revista Médica de Chile*, 128(11), 1199–1204. doi:10.4067/s0034-98872000001100003
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. doi:10.1080/10705519909540118
- Ihm, J., & Hsieh, Y. P. (2015). The implications of information and communication technology use for the social well-being of older adults. *Information, Communication & Society*, 18(10), 1123–1138. doi:10.1080/1369118x.2015.1019912
- van Ingen, E., Rains, S. A., & Wright, K. B. (2017). Does social network site use buffer against well-being loss when older adults face reduced functional ability? *Computers in Human Behavior*, 70, 168–177. doi:10.1016/j.chb.2016.12.058
- Ivan, L. (2019). Using netnography to research older adults' online communities. In B. B. Neves & F. Vetere (Eds.), *Ageing and digital technology: Designing and evaluating emerging technologies for older adults* (pp. 133–150). Springer Singapore. doi:10.1007/978-981-13-3693-5_9
- Jun, H. J., & Kim, M. Y. (2017). What accounts for the relationship between Internet use and suicidal ideation of Korean older adults? A mediation analysis. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 72(5), 846–855. doi:10.1093/geronb/gbw163
- Khechine, H., Lakhal, S., & Ndjambou, P. (2016). A meta-analysis of the UTAUT model: Eleven years later. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 33(2), 138–152. doi:10.1002/cjas.1381
- Klimova, B., Simonova, I., Poulova, P., Truhlarova, Z., & Kuca, K. (2016). Older people and their attitude to the use of information and communication technologies—A review study with special focus on the Czech Republic (older people and their attitude to ICT). *Educational Gerontology*, 42(5), 361–369. doi:10.1080/03601277.2015.1122447
- Kottl, H., Cohn-Schwartz, E., & Ayalon, L. (2020). Self-perceptions of aging and everyday ICT engagement: A test of reciprocal associations. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 76(9), 1913–1922. doi:10.1093/geronb/gbaa168
- Lam, S. S. M., Jivraj, S., & Scholes, S. (2020). Exploring the relationship between Internet use and mental health among

- older adults in England: Longitudinal observational study. *Journal of Medical Internet Research*, 22(7), e15683. doi:10.2196/15683
- Levy, B. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions in Psychological Science*, 18(6), 332–336. doi:10.1111/j.1467-8721.2009.01662.x
- Lifshitz, R., Nimrod, G., & Bachner, Y. G. (2018). Internet use and well-being in later life: A functional approach. *Aging and Mental Health*, 22(1), 85–91. doi:10.1080/13607863.2016.1232370
- Macedo, I. M. (2017). Predicting the acceptance and use of information and communication technology by older adults: An empirical examination of the revised UTAUT2. *Computers in Human Behavior*, 75, 935–948. doi:10.1016/j.chb.2017.06.013
- Mariano, J., Marques, S., Ramos, M. R., Gerardo, F., & de Vries, H. (2020). Too old for computers? The longitudinal relationship between stereotype threat and computer use by older adults. *Frontiers in Psychology*, 11:568972. doi:10.3389/fpsyg.2020.568972
- Miranda-Castillo, C., Contreras, D., Garay, K., Martinez, P., Leon-Campos, M. O., Farhang, M., Moran, J., & Fernandez-Fernandez, V. (2019). Validation of the Geriatric Anxiety Inventory in Chilean older people. *Archives of Gerontology and Geriatrics*, 83:81–85. doi:10.1016/j.archger.2019.03.019
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide*. Author.
- Nimrod, G. (2020a). Changes in Internet use when coping with stress: Older adults during the COVID-19 pandemic. *The American Journal of Geriatric Psychiatry*, 28(10), 1020–1024. doi:10.1016/j.jagp.2020.07.010
- Nimrod, G. (2020b). Technostress in a hostile world: Older Internet users before and during the COVID-19 pandemic. *Aging and Mental Health*, 26(3), 1–8. doi:10.1080/13607863.2020.1861213
- O'Keeffe, E., Mukhtar, O., & O'Keeffe, S. T. (2011). Orientation to time as a guide to the presence and severity of cognitive impairment in older hospital patients. *Journal of Neurology Neurosurgery and Psychiatry*, 82(5), 500–504. doi:10.1136/jnnp.2010.214817
- Pachana, N. A., Byrne, G. J., Siddle, H., Koloski, N., Harley, E., & Arnold, E. (2007). Development and validation of the Geriatric Anxiety Inventory. *International Psychogeriatrics*, 19(1), 103–114. doi:10.1017/S1041610206003504
- Ramírez-Correa, P., Grandón, E., & Painén-Aravena, G. (2017). Efecto de los rasgos de personalidad en el uso de las tecnologías de información. *Multidisciplinary Business Review*, 10(2), 19–26. <https://journalmbr.net/index.php/mbr/article/view/295>
- Robertson, G. (2017). Ageing and ageism: The impact of stereotypical attitudes on personal health and well-being outcomes and possible personal compensation strategies. *Self & Society*, 45(2), 149–159. doi:10.1080/03060497.2017.1334986
- Robertson, D. A., & Kenny, R. A. (2016). "I'm too old for that"—The association between negative perceptions of aging and disengagement in later life. *Personality and Individual Differences*, 100, 114–119. doi:10.1016/j.paid.2016.03.096
- Rojas, E. F., Poveda, L., & Grimblatt, N. (2016). *Estado de la banda ancha en América Latina y el Caribe 2016*. Comisión Económica para América Latina y el Caribe (CEPAL) & Cooperación Alemana. https://repositorio.cepal.org/bitstream/handle/11362/40528/6/S1601049_es.pdf
- Rosell, J., & Vergés, A. (2021). The impact of ageism on the E-leisure of older people in Chile. In Q. Gao & J. Zhou (Eds.), *Human aspects of IT for the aged population. Technology design and acceptance. HCII 2021. Lecture notes in computer science* (Vol. 12786, pp. 228–239). Springer. doi:10.1007/978-3-030-78108-8_17
- Rosell, J., Vergés, A., Torres Irribarra, D., Flores, K., & Gomez, M. (2020). Adaptation and psychometric characteristics of a scale to evaluate ageist stereotypes. *Archives of Gerontology and Geriatrics*, 90, 104179. doi:10.1016/j.archger.2020.104179
- Sims, T., Reed, A. E., & Carr, D. C. (2017). Information and communication technology use is related to higher well-being among the oldest-old. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 72(5), 761–770. doi:10.1093/geronb/gbw130
- Subsecretaría de Telecomunicaciones de Chile. (2017). *IX encuesta de acceso y usos de Internet*. https://www.subtel.gob.cl/wp-content/uploads/2018/07/Informe_Final_IX_Encuesta_Acceso_y_Usos_Internet_2017.pdf
- Swar, B., Hameed, T., & Reyhach, I. (2017). Information overload, psychological ill-being, and behavioral intention to continue online healthcare information search. *Computers in Human Behavior*, 70, 416–425. doi:10.1016/j.chb.2016.12.068
- Szabo, A., Allen, J., Stephens, C., & Alpass, F. (2019). Longitudinal analysis of the relationship between purposes of Internet use and well-being among older adults. *The Gerontologist*, 59(1), 58–68. doi:10.1093/geront/gny036
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478. doi:10.2307/30036540
- Vroman, K. G., Arthanat, S., & Lysack, C. (2015). "Who over 65 is online?" Older adults' dispositions toward information communication technology. *Computers in Human Behavior*, 43, 156–166. doi:10.1016/j.chb.2014.10.018
- Wagner, N., Hassanein, K., & Head, M. (2010). Computer use by older adults: A multi-disciplinary review. *Computers in Human Behavior*, 26(5), 870–882. doi:10.1016/j.chb.2010.03.029
- Wang, Y., Zhang, H., Feng, T., & Wang, H. (2019). Does Internet use affect levels of depression among older adults in China? A propensity score matching approach. *BMC Public Health*, 19(1), 1474. doi:10.1186/s12889-019-7832-8
- Wong, F. H. C., Liu, T., Leung, D. K. Y., Zhang, A. Y., Au, W. S. H., Kwok, W. W., Shum, A. K. Y., Wong, G. H. Y., & Lum, T. Y. (2021). Consuming information related to COVID-19 on social media among older adults and its association with anxiety, social trust in information, and COVID-safe behaviors: Cross-sectional telephone survey. *Journal of Medical Internet Research*, 23(2), e26570. doi:10.2196/26570
- Zhou, J., Zhang, B., Tan, R., Tseng, M.-L., & Zhang, Y. (2020). Exploring the systematic attributes influencing gerontechnology adoption for elderly users using a meta-analysis. *Sustainability*, 12(7), 2864. doi:10.3390/su12072864