

Information Seeking Behavior Associated with Willingness for COVID-19 Vaccination in 60+ Estonians

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Abstract: Research consistently suggests that seeking health information (HI) online can positively impact individuals' health behavior choices (HBC). However, the relationship between online health information-seeking behavior (OHISB) and COVID-19 vaccination among older adults – often considered a digitally underserved group – remained largely underexplored. This study contributes to bridging this gap by investigating the OHISB of Estonians aged 60+ and its associations with HBC, including COVID-19 vaccination readiness (CVR). Survey data from 329 respondents revealed that frequent online HI searches, along with better access to digital devices, higher self-reported digital skills, and higher levels of education and income, were positively associated with increased CVR. Preference for reliable HI sources, such as international organizations and physician-curated websites, further reinforced vaccine support, while vaccine refusers predominantly relied on alternative media. However, no clear association was found between OHISB and other HBCs, such as healthy eating, physical activity, or drug use, suggesting the need for further investigation. The study highlights the potential of digital technologies and online health information seeking (OHIS) among older generations in promoting health-protective behavior during a health crisis. These findings also underscore the critical role of promoting digital literacy and access to credible HI to enhance public health outcomes.


1 INTRODUCTION

Online health information seeking (OHIS) is gaining increasing popularity (Jia et al., 2021). Despite concerns about misinformation online, it is primarily regarded as a positive influence on health behavior (HB), enhancing e-health awareness and enabling more informed health decisions (Heponiemi et al., 2022; Arthanat, 2021; Chu et al., 2021). As individuals face increasing health challenges in later life, OHIS has become a crucial resource for aging populations (Jia et al., 2021; Zhao et al., 2022). The problem is that despite the growing prevalence of information and communication technology (ICT) and access to online health information (OHI), many older adults miss out on these digital advantages or encounter barriers that can be categorized into individual, social, and technological challenges (Zhao et al., 2022). For instance, while nearly all

young individuals in Estonia utilize the internet, the situation is considerably less favorable among older age groups: among 55-64-year-olds, 11% do not use the internet, and among those aged 65-74, the figure is 30% (Statistics Estonia, 2024).

The internet's significance as an information channel was particularly pronounced during the COVID-19 pandemic restrictions when individuals were compelled to forgo or reduce face-to-face interactions and communication. Although COVID-19 is no longer classified as a global health emergency (WHO, 2023), the pandemic offers valuable lessons for future preparedness, which is also true regarding HI-seeking (Bachofner et al., 2024; ECDC, 2023; WHO, 2021).

Older adults (60+), a highly vulnerable group, faced more significant risks from COVID-19 and heightened concerns about vaccine side effects, contributing to skepticism within this demographic

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(Lampkin, 2023). Despite vaccination being the most effective protective measure against the virus, vaccine hesitancy emerged as a significant challenge at the height of the pandemic, hindering efforts to eliminate the virus (de Vries et al., 2022; Verputten et al., 2022). With some exceptions, associations between HI-seeking and vaccination remained relatively unexplored during the health crisis among the older population (e.g., Principe and Weber, 2023). Despite the growing academic focus on OHISB among older adults and its impact on HB, further investigation is needed, particularly in countries with varying levels of digital health infrastructure and access, such as Estonia, where disparities in digital health literacy may pose challenges.

Estonia's advanced e-government, ranked top three globally (UN, 2020) and 9th in the EU's Digital Economy and Society Index (2022) (European Commission, 2024), contrasts with its high elderly poverty rate – 40.6% in 2021, compared to the EU average of 16.8% (Eurostat, 2023). Exploring OHISB among Estonian older adults is vital to inform health communication, design digital health tools, and prepare for future health crises.

The study aims to analyze online health information seeking among Estonian older adults aged 60 and above and explore its relationship to health behavior choices, including their readiness for COVID-19 vaccination. To guide the study, we propose the following research questions:

1. What is the OHISB among Estonian older adults aged 60 and above?
2. How is OHISB related to their health behavior choices (HBC), including COVID-19 vaccination readiness (CVR)?

The following section reviews prior research on older adults' OHISB and its relation to HB, followed by details on the sample, method, results, discussion, conclusions, and references. Abbreviations are clarified in a table in the appendix (see Appendix).

2 LITERATURE REVIEW

This chapter reviews previous research on OHISB among older adults, focusing on influencing factors, the role of the COVID-19 pandemic, and OHISB's association with HBC.

2.1 OHISB in Older Adults

The internet is increasingly pivotal in older adults' HI-seeking, providing accessible and convenient ways to manage their health (Bachofner et al., 2024; Ma et al.,

2023). Older adults' OHISB is influenced by factors beyond socioeconomic status, including age, education, income, technological skills, access methods, psychological attitudes, cognitive ability, and social networks (Bachofner et al., 2024; Enwald et al., 2017). Younger older adults with higher education and income levels engage more frequently, with women seeking OHI more often than men (Choi, 2019; Enwald et al., 2017). Trust in reliable sources and technological proficiency are critical, as misinformation deters use (Zhao et al., 2022; Jia et al., 2021). Chronic conditions and health awareness also drive OHIS engagement (Ma et al., 2023; Pourrazavi et al., 2022; Enwald et al., 2024).

Although the COVID-19 pandemic appeared to drive digital technology use – a prerequisite for OHIS – studies reveal a growing digital divide, both generationally and within older age groups (ELSA, 2021; Martínez-Alcalá et al., 2021; Crick, 2020; van Deursen, 2020; van Dijk, 2020). During COVID-19, low ICT adoption left many older adults isolated from social interaction and digital services, with those of lower education and income particularly vulnerable to digital exclusion, limiting access to OHI and services (Crick, 2020; Seifert, 2020; van Deursen, 2020; van Dijk, 2020). Factors like age, loneliness, and neighborhood deprivation hindered engagement, while higher education and income promoted it (Kung & Steptoe, 2023).

Statistics reveal that in Estonia, the pandemic led to increased digital engagement among older adults. Weekly internet use among Estonians aged 55-75 rose from 69% in 2019 to 74% by 2021 (Eurostat, 2023a). Despite growth, many older adults still face barriers like low digital skills and limited technology access. There is a lack of research on the OHISB of Estonians aged 60+ during COVID-19, with most studies focusing on welfare states and neglecting Eastern European older adults and their HI behavior.

2.2 Associations Between OHISB and Health Behavior

A key consideration in online HI seeking and use is whether it facilitates improved HBC and contributes to better health outcomes. The relationship between OHISB and HB is multifaceted (Koh, 2023; Dadaczynski et al., 2021). Seeking HI online has been broadly linked to positive health outcomes, as increased knowledge about health issues can lead to better management of health, treatment adherence, and preventive strategies (Allington et al., 2021; Dadaczynski et al., 2021). This is particularly beneficial for older adults who may experience

complex health needs, as OHISB offers them opportunities to manage uncertainties and become more proactive in their healthcare (Ausserhofer et al., 2022).

Frequent online engagement and diverse information sources enhance health benefits, with regular HI seekers adopting preventive measures more readily (Zhuang & Cobb, 2022; Chu et al., 2021). However, limited digital literacy among older adults can lead to misunderstandings or discourage protective behaviors, as seen in social media-driven vaccine hesitancy (Eriksson-Backa et al., 2018; Zhang et al., 2024). Excessive social media use has been linked to higher hesitancy (Moon et al., 2023), while credible sources reduce it, as shown during the pandemic (Principe & Weber, 2023). Disparities in access and skills limit these benefits for older adults.

The digital divide among older adults affects OHISB's impact on HB, with higher education, income, and digital skills enabling greater engagement, better awareness of treatments, effective risk management, and easier access to online healthcare (van Deursen, 2020; van Dijk, 2020; Kung & Steptoe, 2023). Misinformation on social media and alternative platforms – especially evident during crises like COVID-19 – can discourage protective HB (Borah et al., 2022; Castellano-Tejedor et al., 2022; Bendau et al., 2021; Figueiras et al., 2021; Cuello-Garcia et al., 2020). Chu et al. (2021) found that accessing diverse information sources during COVID-19 increased engagement in protective health behaviors among older adults.

The COVID-19 pandemic emphasized digital information's role in preventive HBs like CVR and the risks of misinformation (Principe & Weber, 2023; Koh, 2023). It highlighted both the potential and challenges of OHISB for older adults, showing the need for credible, user-friendly online health resources.

Considering the high value placed on digital services in Estonia and the increasing digital engagement among older adults, it is likely that many were online during the COVID-19 pandemic, searching also for HI. Based on previous studies, it can be assumed that the HBC of those who search for HI online differs from those who remain offline.

3 SAMPLE AND METHOD

This study relies on data from a more extensive survey conducted among older Estonian adults by the market research company Norstat in 2020. The company drew a sample from a research panel of

more than 20,000 respondents, inviting them to participate in online, telephone, and face-to-face interviews. All people were randomly selected from earlier surveys (primarily phone interviews) to include sufficiently varied socio-demographic groups. According to quotas, a representative sample was assembled while rigorously ensuring that the number of responses outlined in the quota was collected from each subset (e.g., a particular age group). Although the original sample included 500 respondents aged 50 and over, this study focuses exclusively on people aged 60 and above.

3.1 Participants

The age group 60+ comprised 329 respondents, of whom 155 participants were questioned online and 174 over the phone between 20 July and 3 August. The sample is characterized by the following socio-economic indicators in the table below (see Table 1).

Table 1: Sample Characteristics (N).

Variable		Male	Female	Total
Nationality	Estonian	82	164	246
	Other	39	44	83
Education	Basic	8	17	25
	Secondary	19	43	62
	Vocational	42	64	106
	Higher	52	84	136
Position at work	Employee	8	8	16
	Specialist	18	20	38
	Manager	3	4	7
	Entrepreneur	5	4	9
	Pensioner	84	168	252
Monthly income (in euros)	Other	3	4	7
	Up to 150	0	3	3
	151 – 350	3	21	24
	351 – 550	40	97	137
	551 – 750	31	55	86
	751 – 1000	14	14	28
	1001 – 1250	9	9	18
	1251 – 1500	8	2	10
	Over 1500	4	4	8
	Not known	12	3	15

3.2 Questionnaire

The entire questionnaire included 15 substantive multiple-choice questions as well as questions regarding the socio-demographic profile of the respondents (gender, age, nationality, education level, employed/unemployed) and monthly income. The entire questionnaire can be found [here](#).

For this article, nine questions were selected, focusing on (O)HISB, HB, self-reported health, ICT

access, and willingness to adopt ICT for health purposes. The respondents were asked to choose between multiple-answer options for all questions. The response options varied by question, including yes/no choices, such as access to a digital device, and multiple-choice selections for preferences, like information sources. Digital competence and general health status were rated on a 5-point Likert scale, while the frequency of health information-seeking was measured with four options, ranging from weekly to infrequently. There were no open-ended questions.

3.3 Data Analysis

The data were processed mathematically and statistically with Microsoft Excel using cross-tabulation analysis. For all questions, the following key (i.e., most applied) variables characterizing the respondents were considered: gender, age, education, and self-reported health assessment.

4 RESULTS

This chapter summarizes the study's key findings, focusing on OHISB among Estonians aged 60 and over and its associations with HBC.

4.1 Health Information Behavior

36% of respondents sought HI monthly, including 12% weekly or more, while 42% needed it only a few times annually. Poorer health increased HI needs. Family physicians and healthcare institutions were the primary sources for 75%, followed by the internet (48%), print media (38%), television/radio (32%), and friends/family (27%). Respondents mainly searched for HI on specific illnesses (65%) and disease prevention (45%). Medication information was sought by 29%, health data via the national portal by 22%, and 12% had other purposes.

Among those with access to a computer or smart device (70%, $n=231$), 16% reported never searching for HI online. In contrast, nearly a quarter (23%) had done so within the past seven days, and 29% had searched for HI online within six months or less frequently. For internet users, essential sources of HI online included random sources that appear at the top of search results from Google or other engines (45%). Specialized health and disease-related portals and websites were used by 38%. A third (33%) highlighted professional journalism, such as online news outlets and their health sections. Other sources were mentioned less frequently. Nearly one-fifth

(19%) cited Wikipedia. In comparison, 14% mentioned scientific databases, open-access websites offering scientific information, and forums and discussion groups where people share experiences with doctors and illnesses. Social media platforms (Facebook, Twitter, YouTube, etc.) were mentioned by 11%. Only 10% referred to the websites of international organizations, government agencies, and official institutions, while 15% selected "other." The issues highlighted included the inability to determine whether the information found could be trusted (37%). A third (32%) had difficulties selecting relevant information. However, the majority (45%) did not experience any problems.

Education level played a role: 64% of men with higher education searched for HI online during the last month, compared to 44% with lower education. Among women, 57% with higher education sought HI, versus 54% without a university degree.

4.2 HBC and Links with OHISB

Among all respondents, 64% ($n=209$) reported walking or cycling, while 29% mentioned swimming or going to the gym. Other forms of physical activity, such as gardening, were reported by 66%. Additionally, 61% tried maintaining a healthy diet, which rose to 72% among internet users. Meanwhile, 21% stated they consumed fatty or sugary foods, with internet users reporting this significantly less often at 14%. Approximately 28% of respondents reported a predominantly sedentary lifestyle, with internet users sitting more (61%).

Regarding vaccination, 54% expressed willingness, 29% were unsure, and 16% were unwilling. Men (65%) were more willing to vaccinate than women (48%), with older men (71%) being the most likely. Older women were less likely, with only 46% of those aged 70+ agreeing. Higher education and income correlated with greater willingness, with 65% of higher-educated respondents supporting vaccination, compared to 28% with primary education, where opposition was 44%.

Individuals with computer access were more likely to receive the vaccine (60%) than those without access (42%). Of those for whom the internet was an essential source of HI, 63% were willing to get vaccinated, 27% hesitated, and 10% opposed vaccination. Respondents who more frequently experienced the need for HI exhibited a greater willingness to vaccinate – 61% among those who felt this need at least weekly compared to 48% among those who felt it only a few times per quarter. Individuals who had searched for HI online within the

past month demonstrated a higher willingness to get vaccinated (69%) than those who reported not seeking HI online (39%).

Health-related digital applications and services were more appealing to those interested in vaccination. Only 5% of vaccine refusers were interested in such applications, compared to 90% of vaccine acceptors. Likewise, 64% of those interested in vaccination considered it essential to communicate with a doctor remotely (via a computer or smart device) during the pandemic. In comparison, the figure for those who refused was only 7%. The digital competence category presented no significant variations. However, those who had never used a computer were likelier to refuse vaccination (35%) – conversely, only 7% of those who rated their computer skills as excellent refused.

For vaccine supporters, professional press (73%), specific health-related websites created by healthcare professionals (69%), websites of international organizations and government agencies (67%), as well as research databases (61%) were significantly more important compared to those uninterested in vaccination, whose corresponding figures were 3%, 2%, 4%, and 9%, respectively. While individuals willing to vaccinate were drawn to more reputable and reliable information sources, their interests extended beyond these. They frequently reported using blogs (83%), forums, and discussion groups for personal experiences (78%), and Wikipedia (77%), reflecting a diverse range of information sources. In contrast, non-vaccinators primarily relied on alternative medicine websites (27%), alternative media outlets (30%), blogs (17%), videos (14%), and social media platforms (12%).

No significant differences were observed for OHISB and other health choices, such as healthy eating, drug use, and exercising. Only internet users reported a sedentary lifestyle more frequently.

The internet is a significant source of HI for Estonians aged 60+, alongside healthcare professionals and other sources. It is particularly favored by more educated individuals. Those who searched for HI online and expressed willingness to use health-related digital applications were more inclined toward vaccination.

5 DISCUSSION

The results of this study reveal insights into OHISB and its relationship with health choices, particularly with COVID-19 vaccine readiness. In the following section, we address our research questions.

1. What is the OHISB among Estonian older adults aged 60 and above?

As highlighted in previous studies from other countries (Enwald et al., 2024; Chu et al., 2021; Choi, 2019; Pálsdóttir, 2012), most respondents relied on traditional healthcare providers, such as family physicians, as their primary source. However, the internet also played a crucial role among 60+ Estonians, with almost half of the respondents (48%) identifying it as a primary HI resource. Almost a quarter (23%) of respondents with access to a computer have searched HI online during the last seven days. Still, 16% reported never searching for health information online. The reasons behind this could be explored in future studies, particularly focusing on accessibility barriers.

For internet users, critical sources of HI online included random sources appearing at the top of Google or other search engine results (45%), raising concerns about older adults' ability to assess the quality of this information and thus highlighting issues regarding digital literacy. Many respondents sought information about specific illnesses, indicating that "Dr. Google" plays a vital role as an advisor and diagnostician, while a smaller portion explored preventive health measures and medications.

It seems that Estonian seniors are interested in digital technology in the health context. Greater emphasis should be placed on enhancing digital skills, including the ability to discern relevant health information and detect misinformation, while also fostering interest among those who have not yet adopted ICT.

2. How is OHISB related to their health HBC, including CVR?

The data also shows that those who actively searched for HI online, particularly within the last seven days, were far more likely to express willingness to vaccinate than those who rarely or never searched online. Furthermore, individuals who received HI both from online and traditional sources (e.g., doctors) were more inclined to agree to vaccination. This is associated with the results of Chu et al. (2021), indicating that individuals accessing information from multiple and traditional sources demonstrated greater adherence to protective health behaviors, highlighting the importance of accessing information from diverse sources during a health crisis.

Vaccine opponents were more likely to rely on alternative media and treatment websites, which often

disseminate unverified or misleading information. In contrast, vaccine supporters placed greater trust in professional sources like international organizations, government agencies, and doctor-created websites. This aligns with earlier studies showing that misinformation, primarily disseminated through social media and alternative platforms, can hinder protective health behaviors (e.g., Borah et al., 2022; Castellano-Tejedor et al., 2022; Bendau et al., 2021). This underscores the need to combat misinformation and ensure reliable, evidence-based HI is easily accessible.

Individuals with higher digital competence, particularly those with advanced computer skills, were more willing to vaccinate. This suggests that improving digital literacy could be vital in increasing vaccine uptake as digital tools become more prominent in HI dissemination. Moreover, digital services, such as remote doctor communication, were notably more appealing to those who supported vaccination. This further emphasizes the link between digital engagement and positive health behaviors, suggesting that expanding access to telehealth and other digital health services could enhance vaccine acceptance and other health-related decisions.

However, no definitive connection was identified between digital engagement/OHISB and behaviors such as healthy eating, exercise, or drug use, which warrants further investigation. A sedentary lifestyle among internet users was an exception.

The link between OHISB and CVR could indicate that vaccination was perceived as a critical response to the immediate health threat of contracting the virus during the COVID-19 pandemic, and other health activities, such as healthy eating and exercising, were of secondary importance in the context of the crisis. However, this aspect still requires closer investigation.

Individuals who are more open to technology and innovation may also be more receptive to the COVID-19 vaccine as a novel solution. Engagement with OHIS, credible HI sources and health apps likely reflects higher digital health literacy, driving proactive health and preventive behaviors during a crisis. However, further research is needed to explore these associations and their underlying factors.

The study highlights key points for future research on health information behavior and health decisions in older adults. The small 60+ sample limits generalizations and necessitated the use of descriptive statistics, but findings stress the need for studies on this group's behavior. Conducted early in the pandemic – pre-vaccine rollout – the survey reflects that time but misses insights into vaccine hesitancy

tied to misinformation. Gender disparities also stand out, with women showing more interest in online HI-seeking but less vaccination willingness. Future studies with a significantly larger sample would allow for more detailed analysis and should address confounding factors – e.g., socioeconomic status, social circles, and biases – to deepen understanding.

6 CONCLUSIONS

This study underscores the vital role of the internet in obtaining HI among 60+ people living in Estonians, in a country where digital technologies hold great potential to facilitate aging. People who were more willing to vaccinate were often not only better educated but also more interested in digital technologies and frequent seekers of HI online. This provides a basis for further exploration of the connections between tech-savviness and health-related choices.

People with higher CVR had a wide selection of OHI sources, preferring reliable ones, highlighting the importance of access to multiple and reliable HI sources. Conversely, reliance on alternative media correlated with vaccine hesitancy, reinforcing the need to emphasize educating older adults on identifying and relying on trustworthy health information sources.

A strategic communication and community engagement plan should be mindful that older adults' frequency of seeking online HI, use of multiple and diverse information sources, and readiness to utilize digital technologies for health purposes may positively correlate with their readiness for critical decisions, such as vaccine adoption, which is especially important during a health crisis.

Promoting digital literacy, expanding access to trustworthy HI, and integrating digital services with traditional healthcare are essential strategies to improve public health outcomes, especially as digital health continues to grow in importance.

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APPENDIX

Abbreviations:

CVR	COVID-19 vaccination readiness
HB	health behavior
HBC	health behavior choices
HI	health information
	information and communication
ICT	technology
OHI	online health information
OHIS	online health information seeking
	online health information-seeking
OHISB	behavior