

# COVID-19 health communication strategies for older adults: Chatbots and traditional media

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## Conflict of interest

None declared

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## Abstract

**Background.** The coronavirus disease 2019 (COVID-19) pandemic has significantly accelerated the development and use of new healthcare technologies. While younger individuals may have been able to quickly embrace virtual advancements, older adults may still have different needs in terms of health communication.

**Objectives.** To identify areas of interest and preferred sources of information related to the COVID-19 pandemic among older adults and to verify their eHealth competencies.

**Materials and methods.** The study was conducted between February 2022 and July 2022. It included listeners from the University of the Third Age (U3A) and younger students. Both groups received information about the HealthBuddy+ chatbot, a questionnaire that addressed respondents' interests about COVID-19, and the PL-eHEALS (eHealth Literacy Scale) questionnaire to measure their eHealth competencies.

**Results.** There were 573 participants in the study (U3A listeners – 303 participants, median age: 73 years (interquartile range (IQR): 69–77); young adult students – 270, median age: 24 years (IQR: 23–24). The primary source of information about COVID-19 for older adults was television (84.5%), and for younger adults, internet (84.4%). Among the older adults, only 17% ever interacted with a chatbot (younger adults – 78% respectively), and 19% considered it a trustworthy source of information on COVID-19 compared to 79% of younger respondents. Older adults and younger adults in our study were most interested in COVID-19 treatment methods (45.5% and 69.3%, respectively), symptoms of the disease (36.6% and 35.2%, respectively) and chronic diseases coexisting with COVID-19 (35.0% and 51.5%, respectively). However, their eHealth competencies were generally low (median (Me): 34; IQR: 30–39) compared to younger adults (Me: 42; IQR: 40–47).

**Conclusions.** Health education for older adults should be appropriately tailored to their current needs and differentiated. The level of eHealth competencies of older adults suggests that much work remains to narrow the gap between the eHealth competencies of the younger and older generations.

**Key words:** health education, older adults, information seeking, COVID-19, chatbot

## Background

The COVID-19 pandemic has negatively affected many spheres of life, particularly health, limiting patients' access to diagnosis and treatment, including screening and participation in clinical trials. Faced with difficulties in accessing healthcare facilities, many people turned to the mass media or the internet for information on medical issues of interest. In the context of the ongoing pandemic, we have observed reduced quality of life among older adults, accompanied by an increase in depression and social isolation. These trends have become more pronounced as the situation has deteriorated.<sup>1</sup> Moreover, the digital divide between younger and older people has led to a bigger skills gap and more digital isolation among older adults.<sup>2</sup> The epidemiological situation has forced social and family life to move to the internet, leaving older adults behind. Lack of adequate digital competencies and access to electronic devices limits older adults' contact with family and friends, and prevents them from using the online health services and public services that were developed during the pandemic.<sup>3</sup> These factors make it significantly more difficult for older adults to receive reliable health information.

In response to these barriers and the recent epidemiological situation, several technological solutions for remote communication have been developed, including smartphone applications<sup>4</sup> and chatbots for disease monitoring, risk assessment, information dissemination, or vaccination schedules.<sup>5</sup> Montenegro et al. distinguished 6 goals in healthcare policy for using chatbots. One of these goals is to support older adults.<sup>6</sup> Although this group is often seen as digitally excluded, some studies indicate that chatbots are well accepted by older adults and effective in improving their overall wellbeing, including physical and

mental health.<sup>7,8</sup> Wilczewski et al. showed that older adults reported chatbot-delivered health information to be accessible, practical and with low cognitive load.<sup>9</sup> On the other hand, older respondents who experienced long COVID (median age 63) in the study by Wu et al. indicated doubts about the chatbot's ability to provide relevant health information. Attitudes towards the use of chatbots depend on the subject matter, e.g., in terms of sleep and nutrition or collecting information on symptoms, individuals were positively inclined.<sup>10</sup> A study by Dennis et al. that investigated a telephone intervention (COVID-19 screening hotline) with a chatbot showed that participants rated the chatbot more positively than human agents because they felt more comfortable providing socially undesirable information without fear of judgment or stigma. Furthermore, perceptions of chatbot functionality are linked to the screening hotline provider and trust in that provider, suggesting how important the chatbot source is and whether it is trustworthy.<sup>11</sup>

HealthBuddy+ (Fig. 1), developed by the United Nations Children's Fund (UNICEF) Regional Office for Europe and Central Asia (ECARO) and the World Health Organization (WHO) Regional Office for Europe (WHO/Europe) in May 2020,<sup>12</sup> is one such conversational chatbot, supported by a trusted source. It was designed using natural language processing principles to address the societal need for credible and verified information on COVID-19, quarantine, testing, isolation, and protection, as well as debunking of misinformation. The UNICEF and WHO offices have been involved in adapting chatbot's functionality in 15 countries and 16 languages, including Poland, through the <https://healthbuddy.plus/website> and as an Android and iOS<sup>13</sup> smartphone application.

Data from December 2021 show that the chatbot had 450,000 users at that time, and 10,000 user questions were

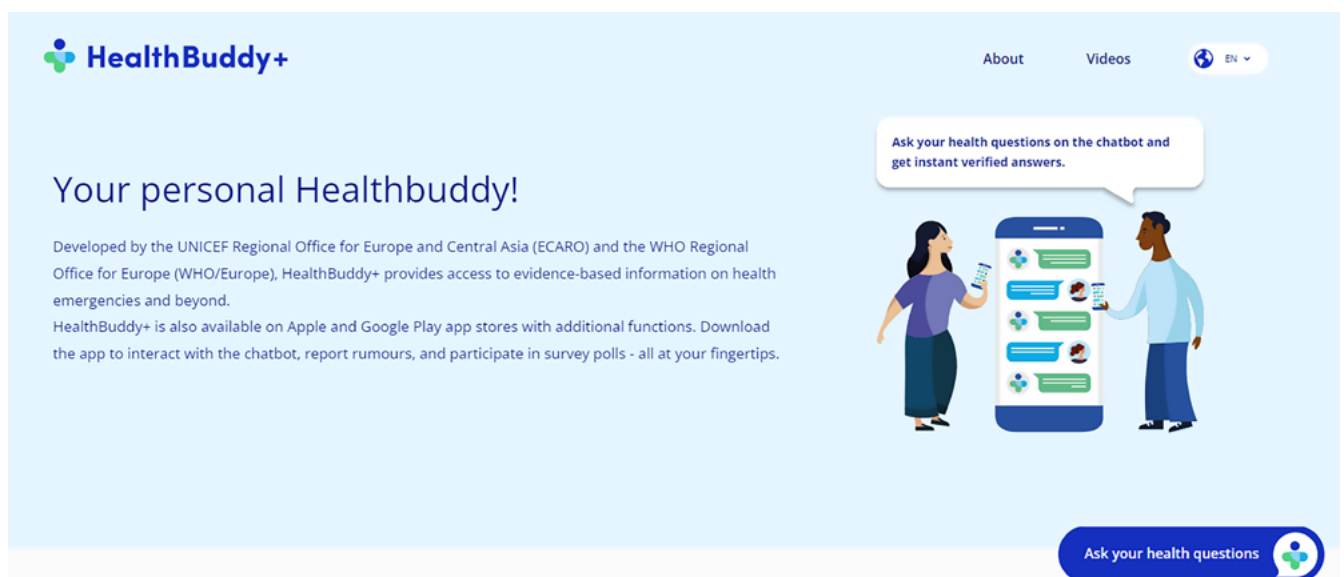


Fig. 1. Screenshot of the HealthBuddy+ chatbot website

analyzed, translated and contextualized by the HealthBuddy+ team at WHO and UNICEF to better understand user needs and improve the chatbot.<sup>14</sup> Our team was also indirectly involved in the improvement presented in this study.

Information about the pandemic, its associated restrictions, protective measures, symptoms, health consequences, and vaccinations had been disseminated through various media.<sup>15</sup> Media such as television, radio and the internet serve not only as essential sources of information but also have the ability to adapt content based on the audience's age or location to ensure effective health communication.<sup>16</sup> This requires an in-depth analysis of the needs of specific populations, their attitudes towards different sources of information, and the potential use of technological solutions such as chatbots for providing health information, which is crucial in such a rapidly evolving technological world.

## Objectives

The launch of the HealthBuddy+ personal COVID-19 assistant encouraged us to explore the awareness of solutions such as chatbots among older and younger adults, the use of such solutions, and to assess whether it is considered a reliable source of health information on COVID-19.

The study aimed to compare the attitudes of older and younger adults towards HealthBuddy+ chatbot as a provider of information about COVID-19, to examine what information about COVID-19 both groups are looking for, and determine their eHealth competencies. We also wanted to find out where older and younger students obtain their information about COVID-19 and what other sources they use.

We hypothesized that older and younger adults differ regarding their experiences with chatbots and their attitudes toward them. We also expected that older and younger people will look for different information about COVID-19 and use different sources.

## Materials and methods

The study was conducted between February 2022 and July 2022 among 573 consecutive participants: young adults, university students (270), and older adults, University of the Third Age (U3A) listeners (303). The median age of older adults was 73 years (interquartile range (IQR): 69–77), and the median age of young adults was 24 years (IQR: 23–24). The majority of participants in both study groups were female: 85% in the group of older adults and 61% in the group of younger adults. Respondents received the questionnaire in paper form. Before completing the questionnaire, respondents were provided with verbal information on the HealthBuddy+ chatbot in the form

of a presentation, accompanied by an instructional video on how to use the chatbot. The questionnaires were distributed to both groups during a recess between classes. A total of 660 surveys were distributed, and 303 were returned from the senior group and 270 from the student group, yielding a 92% and 82% response rate, respectively. The study was conducted in Warsaw and Łódź, 2 cities located in central Poland.

Respondents received a self-administered questionnaire about their interests related to the pandemic and their sources of knowledge about COVID-19. They were also asked whether they had ever interacted with a chatbot and whether they thought it could be a reliable source of information about COVID-19. The questionnaire included additional questions about chronic diseases, vaccination, morbidity and mortality due to COVID-19 among relatives, self-assessment of COVID-19 knowledge, and education level of participants. The 2<sup>nd</sup> part of the study included an eHEALS questionnaire in Polish to examine the eHealth competencies of both groups. This questionnaire was developed by Norman et al. in 2006.<sup>17</sup> In the same year, Norman et al. published the results of the level of these competencies in a group of 664 participants (370 boys, 294 girls) aged 13–21 years (mean = 14.95; standard deviation (SD) = 1.24) measured using eHEALS (eHealth Literacy Scale).<sup>18</sup> This scale quickly became a standard tool for assessing eHealth competencies by various internet participants. In 2019, the questionnaire was validated in a study by Duplaga et al.<sup>19</sup> consisting of 2 samples – sample 1 with 1,000 respondents (women and men) aged (mean ±SD) 64.16 ±9.55 years and sample 2 with 1,030 women aged 18–35 years. For sample 1, Cronbach's  $\alpha$  coefficients were 0.90 and Guttman's distribution coefficients were 0.89, and for sample 2, Cronbach's  $\alpha$  coefficients were 0.88 and Guttman's distribution coefficients were 0.81, confirming the scale's internal consistency. Moreover, Burzyńska et al. examined the Polish version of the eHEALS questionnaire in a representative sample of Polish social media users ( $n = 1,527$ , women = 89.8%, mean age 32 ±10.37 years, Cronbach's  $\alpha = 0.84$ ).<sup>20</sup> We decided to use the eHEALS questionnaire to support our study with a validated survey investigating reasons for the preferred sources of health information and provide a view of the eHealth competencies of participants.

## Statistical analyses

The statistical analysis was carried out with Statistica v. 13.0 (StatSoft Inc., Tulsa, USA). The normality of the distribution of continuous variables was verified using the Shapiro–Wilk test. None of the continuous variables (age of participants and results from the eHealth questionnaire) were normally distributed. Continuous data are presented as median and IQR, and categorical variables as number and percentage. The Pearson's  $\chi^2$  test or Pearson's  $\chi^2$  test with Yates's correction (when at least 1

of the expected values was less than 5) was used to assess differences in categorical variables in both analyzed groups. Mann–Whitney U test was utilized to compare continuous variables. The presentation of test results also includes:  $\chi^2$  statistics Pearson's  $\chi^2$  test, z statistics Mann–Whitney U test and the degrees of freedom (df). A  $p < 0.05$  was considered statistically significant.

## Results

The questionnaire was completed by 573 participants: 303 seniors and 270 students. The median age of seniors was 73 years (IQR: 69–77), and the median age of students was 24 years (IQR: 23–24). Women were the majority in both studied groups: 85% in the senior group and 61% in the student group. The older adults attended U3A, while younger adults were university students. All college students had secondary education, while almost half of seniors (46%) had higher education. The experiences with COVID-19 among respondents and their relatives differed in both groups. Among the elderly, those ever diagnosed with COVID-19 represented 18%, hospitalization of a relative or friend accounted for 23%, and 20% reported that

a relative or friend had died due to COVID-19. The respective ratios for younger participants were 34%, 24% and 12%. Details are presented in Table 1.

Most older adults in our study have never come across a chatbot (83%) and believe that a chatbot is not a reliable source of information about COVID-19 (33%) or have no opinion in this regard (48%). The young adults believe the opposite – a chatbot may be a reliable form of communicating information about COVID-19 (79%). In this group, 78% had previously encountered a chatbot of any kind (Table 2). Older adults and younger adults in our study were most interested in COVID-19 treatment methods (45.5% and 69.3%, respectively), symptoms of the disease (36.6% and 35.2%, respectively) and chronic diseases co-existing with COVID-19 (35.0% and 51.5%, respectively). Interest in COVID-19 vaccination was twice as high among students as among older adults (58.2% and 29.0%, respectively). These observations were statistically significant ( $p < 0.001$ ) (Table 3). The preferred source of information on COVID-19 for older people was television (84.5%), while for younger people, it was the press and the internet (84.4%). Interestingly, it was younger people rather than older people who preferred information obtained from medical personnel (62.8% and 14.8%, respectively) (Table 4).

**Table 1.** Sociodemographic characteristics and experiences regarding COVID-19 of study participants

Variable		Older adults		Younger adults	
		n	n (%)	n	n (%)
Sex: women		303	258 (85%)	270	166 (61%)
Age [years], Me (IQR)		294	73 (69–77)	270	24 (23–24)
Educational status	Elementary		11 (4%)		–
	Secondary	302	151 (50%)	270	270 (100%)
	High		140 (46%)		–
Household	I live with other family members		157 (52%)		122 (45%)
	I live alone	–	145 (48%)	270	55 (20%)
	I live with flatmates		–		93 (34%)
COVID-19 experience	Have you ever been diagnosed with COVID-19?	302	55 (18%)	269	92 (34%)
	Has anyone in your surroundings – family, close friends – been hospitalized due to COVID-19?	302	68 (23%)	270	66 (24%)
	Has anyone in your family or close friends died from COVID-19?	301	60 (20%)	270	33 (12%)

Me – median; IQR – interquartile range.

**Table 2.** Contact with chatbot among older adults and younger adults

Survey questions on chatbot use		Older adults		Younger adults		$\chi^2$ test
		n	n (%)	n	n (%)	
Have you ever come into contact with a chatbot?	Yes	276	46 (17%)	267	207 (78%)	$\chi^2 = 202,02$ df = 1 $p < 0.001$
	No		230 (83%)		60 (22%)	
Do you think that an online automated consultant could be a reliable source of information about COVID-19?	Yes	277	53 (19%)	265	209 (79%)	$\chi^2 = 226,49$ df = 2 $p < 0.001$
	No		92 (33%)		53 (20%)	
	I don't know		132 (48%)		3 (1%)	

df – degrees of freedom.

**Table 3.** Which of the following COVID-19 issues interest you most?

Interests regarding COVID-19	Older adults n = 303	Younger adults n = 270	$\chi^2$ test
What is COVID-19	74 (24.4%)	20 (7.4%)	$\chi^2 = 30.141$ df = 1 p < 0.001
COVID-19 symptoms	111 (36.6%)	95 (35.2%)	$\chi^2 = 0.130$ df = 1 p = 0.718
How COVID-19 is spread	73 (24.1%)	42 (15.6%)	$\chi^2 = 6.486$ df = 1 p = 0.011
COVID-19 treatment methods	138 (45.5%)	187 (69.3%)	$\chi^2 = 32.708$ df = 1 p < 0.001
Contact with a person infected with COVID-19	44 (14.5%)	63 (23.3%)	$\chi^2 = 7.300$ df = 1 p = 0.007
Chronic diseases and COVID-19	106 (35.0%)	139 (51.5%)	$\chi^2 = 15.877$ df = 1 p < 0.001
Vaccinations against COVID-19	88 (29.0%)	157 (58.2%)	$\chi^2 = 49.415$ df = 1 p < 0.001
Populations at the highest risk of developing COVID-19	76 (25.1%)	58 (21.5%)	$\chi^2 = 1.033$ df = 1 p = 0.310
Side effects after vaccination	83 (27.4%)	61 (22.6%)	$\chi^2 = 1.748$ df = 1 p = 0.186
Tests for COVID-19	40 (13.2%)	79 (29.3%)	$\chi^2 = 22.374$ df = 1 p < 0.001
Personal protection methods	51 (16.8%)	55 (20.4%)	$\chi^2 = 1.186$ df = 1 p = 0.276

df – degrees of freedom.

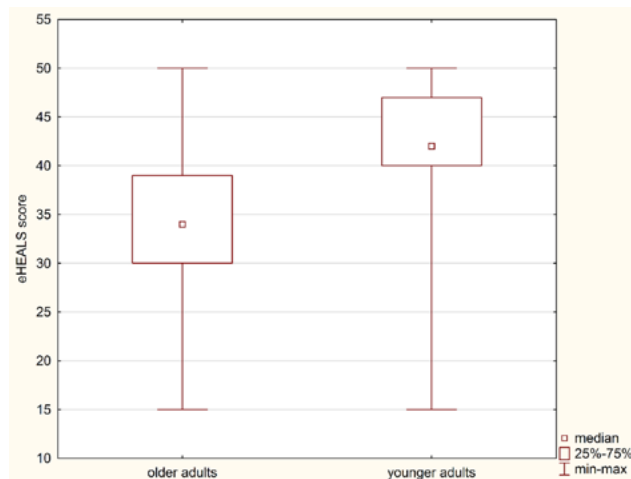
To inform participants about the pandemic, we also inquired whether COVID-19 issues are addressed in university classes, including traditional universities and U3A. Among older adults, 17.2% indicated that these classes were a source of knowledge for them, compared to 61% of younger adults (Table 4).

Older adults' eHealth competencies were significantly lower than those of students. The median of the overall eHEALS score was 34 (IQR: 30–39) for older adults and 42 (IQR: 40–47) for students ( $z = -13.886$ ,  $df = 422$ ,  $p < 0.001$ ) (Fig. 2). In particular, intergenerational differences emerged in questionnaire items such as: "I know what health resources are available on the internet", "I know where to find helpful health resources on the internet", "I have the skills I need to evaluate the health resources I find on the internet", "I can tell high-quality health resources from low-quality health resources on the internet", and "I feel confident in using information from the Internet to make health decisions". For all questions of the eHEALS questionnaire, the differences in responses were statistically significant

**Table 4.** Preferred source of information on COVID-19

Source of knowledge about COVID-19	Older adults n = 291	Younger adults n = 269	Pearson's $\chi^2$ test
TV	246 (84.5%)	46 (17.1%)	$\chi^2 = 254.739$ df = 1 p < 0.001
Radio	83 (28.5%)	15 (5.6%)	$\chi^2 = 50.978$ df = 1 p < 0.001
Press, internet	164 (56.4%)	227 (84.4%)	$\chi^2 = 52.118$ df = 1 p < 0.001
University lectures	50 (17.2%)	164 (61.0%)	$\chi^2 = 113.496$ df = 1 p < 0.001
Medical staff	43 (14.8%)	169 (62.8%)	$\chi^2 = 137.177$ df = 1 p < 0.001
Family	69 (23.7%)	30 (11.2%)	$\chi^2 = 15.150$ df = 1 p < 0.001
Friends	55 (18.9%)	38 (14.1%)	$\chi^2 = 1.970$ df = 1 p = 0.160
Others	7 (2.4%)	18 (6.7%)	$\chi^2 = 5.060$ df = 1 p = 0.025

df – degrees of freedom.



**Fig. 2.** eHEALS (eHealth Literacy Scale) Score in older adults and young adults

( $p < 0.001$ ). Detailed results of the eHealth competencies questionnaire are shown in Table 5.

## Discussion

Our study showed that, unlike the younger group, most older respondents had never had contact with any chatbot. One of the reasons may be that older individuals prefer face-to-face interactions with another person, which is confirmed by some studies.<sup>21,22</sup> Others indicate older adults are

**Table 5.** eHealth competencies of older adults and students measured with the validated eHEALS (eHealth Literacy Scale) questionnaire in Polish

eHEALS	Older adults		Younger adults		Mann-Whitney test
	n	Me (IQR)	n	Me (IQR)	
How useful do you feel the internet is in helping you in making decisions about your health?	261	4 (3–4)	169	4 (4–5)	$z = -7.5564$ df = 428 $p < 0.001$
How important is it for you to be able to access health resources on the internet?	251	4 (3–4)	169	5 (4–5)	$z = -11.4155$ df = 418 $p < 0.001$
I know what health resources are available on the internet	252	3 (3–4)	167	4 (4–5)	$z = -10.8363$ df = 417 $p < 0.001$
I know where to find helpful health resources on the internet	245	3 (3–4)	169	4 (4–5)	$z = -11.4367$ df = 412 $p < 0.001$
I know how to find helpful health resources on the internet	244	4 (3–4)	168	4 (4–5)	$z = -10.2334$ df = 410 $p < 0.001$
I know how to use the Internet to answer my questions about health	244	4 (3–4)	168	4 (4–5)	$z = -9.4799$ df = 410 $p < 0.001$
I know how to use the health information I find on the internet to help me	233	4 (3–4)	169	4 (4–5)	$z = -9.2977$ df = 400 $p < 0.001$
I have the skills I need to evaluate the health resources I find on the internet	232	3 (3–4)	168	4 (4–5)	$z = -9.1049$ df = 398 $p < 0.001$
I can tell high-quality health resources from low-quality health resources on the internet	231	3 (3–4)	168	4 (4–5)	$z = -9.7260$ df = 397 $p < 0.001$
I feel confident in using information from the Internet to make health decisions	232	3 (3–4)	169	4 (3–4)	$z = -6.9180$ df = 399 $p < 0.001$

Me – median; IQR – interquartile range; df – degrees of freedom.

less willing to use technological solutions and learn to use them, which is linked to a combination of factors, including the lack of intergenerational activities within the family, difficulties in using devices, screens being too small to use comfortably, or anxiety about using technology.<sup>23</sup>

Moreover, in our study, some older respondents believed that a chatbot could not be a reliable source of information on COVID-19 or had no relevant opinion – which may be caused by the fact that most of them had never interacted with a chatbot before. In contrast, younger respondents had a predominant belief that it could be a reliable tool, while the proportion of younger respondents who have obtained information from a chatbot before was 78%. This may suggest that a lack of conviction results from not using such technological solutions. Interestingly, some other studies indicated that chatbots might be the most favored channel for sharing symptoms related to COVID-19 as they provide anonymity and reliable information.<sup>11,24</sup> Furthermore, it has been shown that chatbots can positively model health attitudes towards COVID-19 vaccination and influence health behavior.<sup>25</sup> Gudala et al. showed that, despite technological barriers, most older adults are sufficiently familiar with chatbot technology, especially those with higher socioeconomic

status.<sup>26</sup> As mentioned in the Introduction, some studies indicate that chatbots are well-accepted by older adults and effective in improving their overall wellbeing.<sup>9</sup>

The primary source of information about COVID-19 among older respondents in our study was traditional media, particularly television. These findings are consistent with other studies,<sup>27–29</sup> but it is noteworthy that some respondents used the open question space to ask whether the provided information could be considered reliable. Consequently, they were not convinced that the information provided on television was reliable. Nevertheless, studies showed a positive correlation between the information presented on television regarding prevention, COVID-19 protection measures and health behavior in society, which may indicate that health information should reach older adults through this source.<sup>30,31</sup> The study by Wang et al. used this correlation to teach older adults to use the internet through TV sets connected to internet (Smart TV), which has proven to be an effective tool for the digital inclusion of older adults.<sup>23</sup> Only a small percentage of older respondents (17.2%) reported receiving information about COVID-19 from U3A classes. This is likely related to the fact that many of these institutions suspended their activities during the pandemic.

The technological advances we are witnessing cannot be stopped, so efforts to provide health information should be tailored to the population and vary according to the target group. Reaching out to older adults through traditional media is just one method, but older adults are not a homogeneous group; therefore, activating them in technology-oriented activities should be addressed. Given the vast technological advances between 2020 and 2024, including the development of artificial intelligence (AI), we can see changes in public attitudes toward chatbots and the potential for patient education explored in many studies.<sup>32–34</sup>

Furthermore, older participants indicated they were interested in COVID-19 treatment methods, symptoms of COVID-19 infection and its impact on chronic diseases. The categories selected by older adults suggest that even basic information about COVID-19 is not reaching them. Studies conducted at the beginning of the pandemic showed similar results – older adults were unsure about COVID-19 symptoms<sup>35</sup>; however, it is somewhat concerning as our research was conducted in 2022. There was a lot of information available from various sources, but this may lead to misinformation caused not only by misinformation from social media or the internet but also by the multiplication of misinformation by family members who pass it on to older relatives.<sup>36</sup> Topics related to vaccination were of more interest to younger respondents, which corresponds with the study by Elsner et al. conducted among high school students.<sup>37</sup> In another study conducted in Germany, students expressed the greatest interest in the spread of SARS-CoV-2 (89.6% of respondents), pandemic-related restrictions (85.9%) and personal protective measures (45.5%).<sup>38</sup> This may depend, in part, on the time in which the study was conducted, health policy changes occurring in the countries during the pandemic, or waves of infection.

One of the reasons for not utilizing technological solutions such as chatbots among older adults may be inadequate eHealth competencies. Thus, our study also examined the eHealth competencies of respondents. Results from the eHEALS questionnaire showed that the eHealth literacy of older adults was lower than that of the young adult population. Studies confirm that the eHealth competencies of older adults are low.<sup>39–41</sup> Although our older participants mainly had secondary or higher education, their eHealth competencies were still low, unlike in other studies<sup>42–45</sup> that found an association between low eHealth competencies and lower levels of education. Low levels of eHealth competencies may also be linked to poor digital competencies,<sup>46</sup> and both pose serious barriers to the use of technological solutions such as chatbots.

## Limitations

This study has several limitations that could affect its results. First, our research was conducted on a non-randomized convenience sample. Therefore, the findings

cannot be generalized to the entire population. Second, both analyzed groups were specific. Older respondents who were U3A listeners were assumed to be more open to acquiring knowledge and more educated than the average older adults. The students, in turn, were mainly medical school students, which may have an impact on their knowledge and information-seeking methods on medical topics. Third, the author's questionnaire used in the study was not validated, and no pilot study was conducted. Fourth, the questionnaires were self-administered, which may have led to self-report bias, e.g., false or inaccurate answers, although the researchers supervised the completion of the questionnaires and respondents answered questions about the questionnaires. Fifth, most of the respondents were women, but some studies suggest that gender is unlikely to affect willingness to use chatbots.<sup>47</sup>

## Conclusions

Our study showed that despite the technological advances observed during the COVID-19 pandemic in disseminating information to different audiences, older adults still prefer to receive information through traditional media such as television. The categories of COVID-19-related areas of interest indicated by the older adults and the questions included in the questionnaire suggest that even basic information about the disease and the virus still needs to be improved. The level of eHealth competencies of the older adults and responses to the chatbot questions suggest that there is still a lot of work to be done to narrow the gap between the eHealth competencies of the younger and older generations. Digital health skills among older adults require attention and appropriate interventions. Given the positive impact of chatbots on the health behavior of older adults, workshops and exercises for seniors on the informed use of these applications should be considered, as well as greater involvement of older adults in activities on the use of technology – smartphones, computer, software – to ensure that they are not left behind in the process of technological progress that continues unabated. Intergenerational activities would also be a viable approach regarding health technology education and preventing social isolation. Future research should, therefore, focus on these issues, taking advantage of the new opportunities offered by AI.

## Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Consent for publication

Not applicable.

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