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BRIEF REPORT

Wellbeing, loneliness, health-related quality of life and perception of technology of older adults in Slovenian senior homes: a cross-sectional study

[version 1; peer review: 1 approved, 1 approved with reservations]

Dean Lipovac[1,2], Mateja Erce[1]

[1]InnoRenew CoE, Izola, Slovenia
[2]University of Primorska, Koper, Slovenia

v1 **First published:** 13 Nov 2023, **3**:195
https://doi.org/10.12688/openreseurope.16205.1
Latest published: 13 Nov 2023, **3**:195
https://doi.org/10.12688/openreseurope.16205.1

Abstract

Background: Older adults can experience loneliness, low wellbeing, and poor health, while certain technologies could alleviate some of these issues. This paper presents findings from a study conducted in Slovenian senior homes, examining the wellbeing, loneliness, health-related quality of life, and perceptions of technology among older adults without significant cognitive issues.

Methods: Older adults (n = 73) responded to questionnaires on wellbeing, loneliness, and health-related quality of life. They also provided their opinion on four different types of technology: a smartphone (SeniorsPhone) and television-based video calling system adapted to older adults (Daisy), a smartwatch (Fitbit), and an air quality sensor.

Results: The results indicate that most examined older adults experience low or moderate levels of loneliness, and most are characterized by average or high levels of wellbeing. The participants also report no significant issues with self-care and accomplishing daily activities. However, more than half of the participants report experiencing some problems with pain/discomfort and mobility. Older adults generally trust evaluated technologies with their personal data, believe that the technologies provide reliable information, and perceive technologies as useful. Interestingly, older adults that reported higher levels of wellbeing and lower levels of loneliness tended to perceive the smartwatch as more usable. This suggests that at least for some technologies, the perception of usability depends on how people feel in general.

Conclusions: Residents of Slovenian senior homes that do not have significant cognitive issues report relatively high wellbeing and health-related quality of life and low loneliness, together with positive

Open Peer Review

Approval Status ✓ ?

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version 1 13 Nov 2023	✓ view	? view

1. **Rozeta Draghici**, National Institute of Gerontology and Geriatrics "Ana Aslan", Bucharest, Romania
Alexandra Rusu, National Institute of Gerontology and Geriatrics "Ana Aslan", Bucharest, Romania, Bucharest, Romania

2. **Luc de Witte**, The Hague University of Applied Sciences, The Hague, The Netherlands

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perceptions of different technologies. These findings can be used to inform the development of age-appropriate technologies for senior home residents.

Keywords
older adults, retirement homes, wellbeing, loneliness, health-related quality of life, technology perception, technology usability



This article is included in the Horizon 2020 gateway.



This article is included in the Health, Ageing and Mortality collection.

Corresponding author: Dean Lipovac (dean.lipovac@innorenew.eu)

Author roles: Lipovac D: Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Erce M**: Data Curation, Investigation, Methodology, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No. 857188 (Pilots for Healthy and Active Ageing) and No. 739574 (Renewable materials and healthy environments research and innovation centre of excellence). The authors gratefully acknowledge the Republic of Slovenia (Investment funding of the Republic of Slovenia and the European Union of the European Regional Development Fund InnoRenew CoE.
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: Lipovac D and Erce M. **Wellbeing, loneliness, health-related quality of life and perception of technology of older adults in Slovenian senior homes: a cross-sectional study [version 1; peer review: 1 approved, 1 approved with reservations]** Open Research Europe 2023, **3**:195 https://doi.org/10.12688/openreseurope.16205.1

First published: 13 Nov 2023, **3**:195 https://doi.org/10.12688/openreseurope.16205.1

Introduction

The aging population represents a vulnerable and rapidly growing demographic in Europe. Age-related challenges, both psychosocial and physical in nature, necessitate targeted interventions (Hatton *et al.*, 2020; ten Bruggencate *et al.*, 2019; Zallio *et al.,* 2016). The integration of technology into the built environment offers promising opportunities to alleviate the burden on caregivers and enhance the well-being and active aging of older adults (Chrysikou, 2018; Rogers & Fisk, 2010; Thielke *et al.*, 2012). Technology can play a crucial role in meeting the basic safety and psychological needs of older adults, reducing social isolation, promoting feelings of safety and independence, and improving care and quality of life (Barbosa Neves *et al.*, 2019; Bixter *et al.*, 2018; Chopik, 2016; Hatton *et al.*, 2020; Thielke *et al.*, 2012).

Despite the potential benefits, a significant proportion of older adults exhibit reluctance to embrace smart technologies (Zallio *et al.,* 2016) due to individual differences and unmet needs that technology alone fails to address (Rogers & Fisk, 2010). Several barriers hinder the acceptance and adoption of technology among older adults, including inadequate training and instructional materials, negative perceptions of technology, concerns regarding privacy, and perceived lack of usefulness and usability (Andrews *et al.*, 2019; Astell *et al.*, 2020; Hatton *et al.*, 2020; Kamin *et al.*, 2020; Rogers & Fisk, 2010; Thielke *et al.*, 2012).

This study aimed to identify older adults' levels of wellbeing, loneliness, and health-related quality of life as well as their perception of different technologies that could promote their independence (and if wellbeing, loneliness, and health-related quality of life are associated with different aspects of technology perception).

Methods

Study location and participants

The study was conducted in three senior homes located in the coastal region of Slovenia (Izola, Lucija, and Olmo). A total of 73 participants without significant cognitive issues were recruited for the study (i.e., participants that formal caregivers perceived as cognitively capable of using tested technologies). We were first given a list of senior home residents for whom the senior home staff believed they were cognitively capable of participating in our study. We approached each of those participants in person, described the study, and invited them to participate. Approximately 40% of invited individuals decided to participate in the study. The recruitment and data collection took place in December 2023. The questionnaires were administered either in the common rooms of retirement homes or in the private rooms of participants by one of the authors of the article. The average age of participants was 83; they were predominantly female, and with a completed high school education or lower. We did not conduct separate analysis by sex; the sample size for each group was relatively small, we did not expect significant differences between sexes, and the goal of the study was to acquire a holistic understanding of the situation. While most participants had some general experience with technology, few considered themselves experienced or skilled in its use. The statistical power calculation showed that our study sample (n = 73) was sufficiently large to detect even a low correlation coefficient (r = 0.35) with a high probability ($1 - \beta = 80\%$), given the standard alpha size ($\alpha = 0.05$).

Tested technologies

The study tested the following technologies:

- Smartwatch (Fitbit Versa 2): This device monitored and provided real-time data on health metrics such as heart rate, step count, and calories burned.
- Video-conferencing system (Daisy from SenLab): This system enabled communication between residents and their relatives or friends. Older individuals accessed the Daisy system through a television. They logged in to the system by placing their personal card on the NFC reader, and they navigated through the interface with the help of a remote control.
- Smartphone (SeniorsPhone from SenLab): This Android launcher was designed to simplify smartphone usage for older adults. It facilitates tasks such as making calls, sending texts, and locating and contacting caregivers, relatives, and friends.
- Air quality sensor: The sensor monitored room temperature, humidity, presence of hazardous particles (PM2.5, PM10), carbon dioxide (CO2), and volatile organic compounds (VOCs). Older adults could see these data displayed on the sensor at all times, and the data were color coded based on the appropriateness/safety of values: red for risky values (e.g., high CO2 values), orange for suboptimal values, and green for values in the safe range.

Measures

Several questionnaires were administered to assess different aspects of participants' well-being, loneliness, health-related quality of life, and perceptions of technology. The measures examined:

- Well-being: The well-being of older adults was assessed using the WHO-5 questionnaire, which is a valid subjective measure of current mental well-being of a respondent with good construct validity. It consists of five statements related to one's wellbeing in the last two weeks (Topp *et al.*, 2015).
- Loneliness: The UCLA Loneliness Scale is a valid 20-item questionnaire that captures a unidimensional model of loneliness. Subjects respond to statements on the scale from "I often feel this way" to "I never feel this way" (Russell *et al.*, 1978).
- Health-related quality of life: The EQ-5D-3L questionnaire was employed to evaluate the health-related quality of life of the participants. This measure assesses various dimensions of health, including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (EuroQol Research Foundation, 2019).

- Trust in technologies: The Almere questionnaire was administered to assess the participants' trust in the technologies included in the study. This measure evaluated how people perceived technologies' reliability, usefulness, and protection of personal data (Heerink *et al.*, 2010).
- Usability of technologies: The System Usability Scale (SUS) was utilized to assess the older adults' perceptions of the usability of the technologies under investigation. The SUS is a well-established scale that provides a reliable assessment of usability (Lewis, 2018).
- Training Evaluation Inventory: This is a valid questionnaire for measuring subjective enjoyment of training, perceived usefulness and difficulty, subjective knowledge gain, and attitude towards training (Ritzmann *et al.*, 2014).

The measures used in the study are available in the Zenodo repository (Lipovac & Erce, 2023), except for the EQ-5D-3L questionnaire, which can only be accessed through online registration.

Data collection

Data collection was conducted through face-to-face interviews with participants. Trained researchers administered the questionnaires and provided any necessary assistance to ensure comprehension and accurate responses. The researchers also provided technology training for the participants that lasted approximately 5 minutes per device. Questionnaires on wellbeing, loneliness, health-related quality of life, and technology training evaluation were administered at the beginning of the study. Questionnaires capturing trust in technologies and Fitbit and SeniorsPhone usability were administered after participants were able to use the technologies for approximately one week. For some questionnaires, data is available from only a subset of participants (21 for Technology Evaluation Inventory and 10 for Trust in technologies and System Usability scale).

Ethical considerations

Ethical approval was obtained from The National Medical Ethics Committee of the Republic of Slovenia board prior to conducting the study (0120-343/2022/5). Informed consent was obtained from all participants, emphasizing voluntary participation, confidentiality, and the right to withdraw from the study at any time. The informed consent form was verbally summarized by a researcher, and participants had the opportunity to read it carefully before signing. The informed consent form stated that the (anonymized) data would be used and shared publicly for research purposes.

Data analysis

Data analysis was conducted using R software. Datasets and the R analysis script are available online (Lipovac & Erce, 2023). Descriptive statistics, including means, frequencies, and percentages, were calculated to summarize the participants' characteristics, questionnaire responses, and technology perceptions. The correlogram presented in the Results section presents Pearson correlation coefficients between different variables. The variables included in the correlogram are based on the previously described questionnaires:

- WHO-5 (Wellbeing)
- UCLA (Loneliness)
- EQ-5D-3L (Health-related quality of life)
- EQ-5D-3L VAS (Self-rated health)
- Training Evaluation Inventory (Technology training evaluation)
- Almere (Trust in technologies)
- SUS (Fitbit and SeniorsPhone usability)

Fields that are crossed out in the correlogram represent a correlation coefficient that is not statistically significant ($p >= 0.05$).

Results

Wellbeing

Based on the results of the WHO-5 questionnaire, most older adults are characterized by average or high wellbeing (Figure 1).

Loneliness

According to the results on the UCLA loneliness scale, a large majority of older adults experience low or moderate loneliness, and relatively few participants experience moderate-high or high loneliness (Figure 2).

Health-related quality of life

Based on the EQ-5D-3L questionnaire scores, most participants experience no issues with self-care and accomplishing their usual daily activities. Similarly, most participants do not report experiencing anxiety/depression. On the other hand, more than half participants experience at least some problems with pain/discomfort and mobility (Figure 3).

When older adults were asked to rate their health on a scale from 0 (worst possible health they could imagine) to 100 (best possible health they could imagine), a very large majority of participants reported a value of 50 or higher, and a relatively high proportion of participants reported very high values (Figure 4).

Perception of tested technologies

On the Almere questionnaire, older adults reported a relatively high trust in technologies. They generally trust the tested technologies with their personal data, believe that the technologies provide reliable information, and perceive technologies as useful (Figure 5).

According to the results on the System Usability Scale, older adults generally rated the usability of the SeniorsPhone with middle values on the usability scale. Fitbit's usability was generally rated higher (Figure 6).

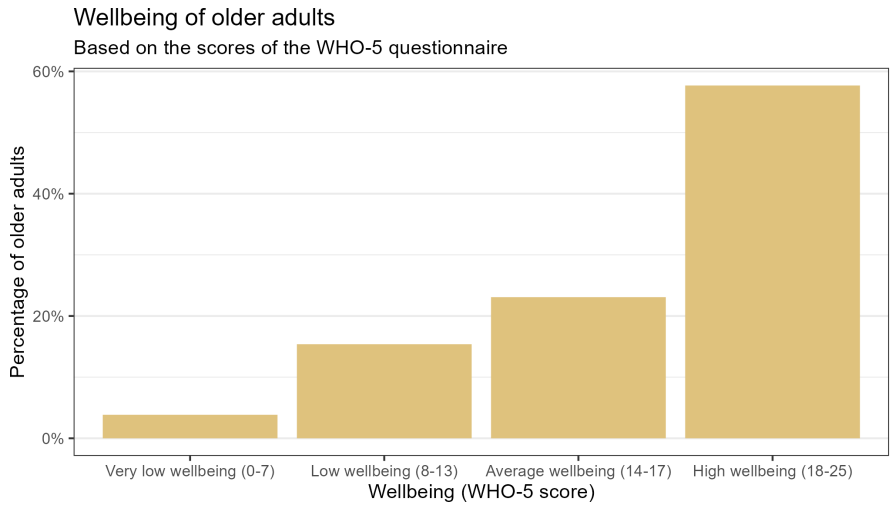

Figure 1. Most older adults report average of high wellbeing.

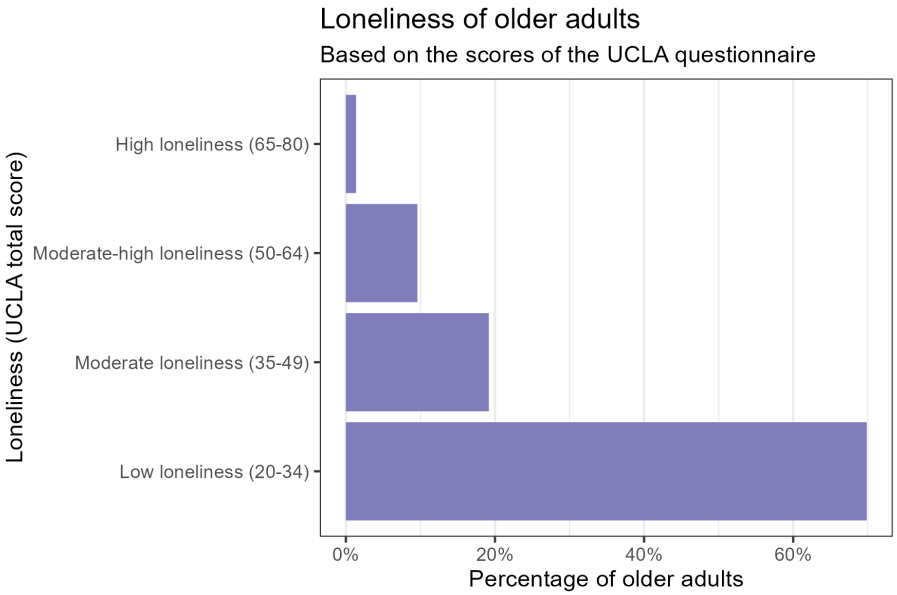

Figure 2. Most older adults report low or moderate levels of loneliness.

On the Training Evaluation Inventory, older adults rated the training they received before using the new technologies as positive. In general, they reported that the training was informative, useful, simple, and enjoyable, and they expressed a positive attitude towards the training (Figure 7).

Association between variables on health, wellbeing, loneliness, health-related quality of life, and variables related to technology

People that reported higher wellbeing tended to report better health, health-related quality of life, and lower loneliness. Those that perceived one technology (e.g., Fitbit) as more usable tended to perceive the other technology as more usable as well (e.g., SeniorsPhone). Higher perceived usability of technologies was positively correlated with overall trust in the technologies - belief that the technologies can be trusted with personal data, provide reliable information, and are generally useful. Participants who reported higher wellbeing tended to perceive Fitbit (but not SeniorsPhone) as more usable than others (Figure 8).

Discussion

The aim of this study was to explore wellbeing, health, and loneliness of older adults, and their perception of different

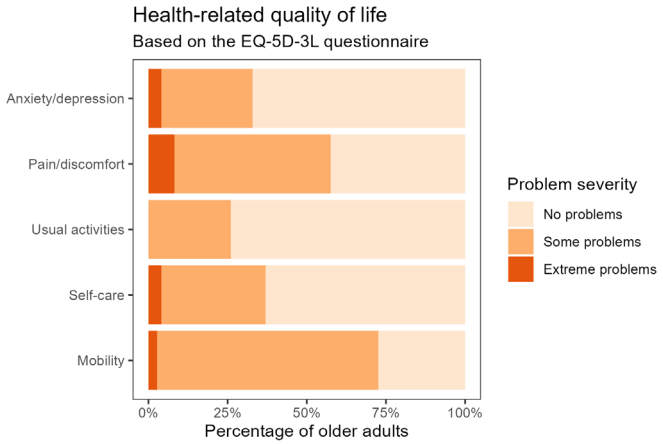

Figure 3. Most older adults had no problems with most aspects of health-related quality of life.

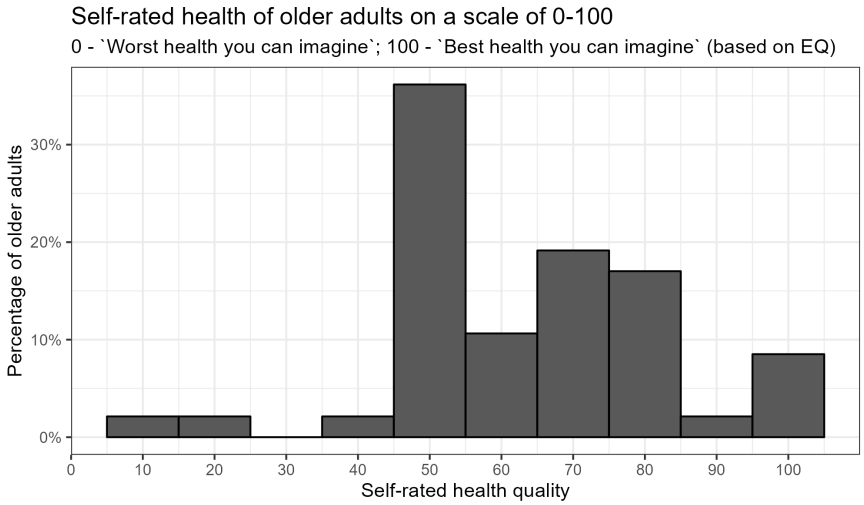

Figure 4. Most older adults rated their overall health with the number 50 or higher on a 0-100 scale.

technologies, as well as to investigate the association between these constructs.

The results indicated that most participants exhibited average or high levels of well-being. This is an encouraging finding, suggesting that the residents of Slovenian senior homes, at least those without significant cognitive issues, are generally characterized with good mental health. It is important to consider positive wellbeing of older adults as a facilitator in promoting the acceptance and adoption of technology. When individuals have a higher sense of well-being, they may be more open to trying new technologies, and more likely to successfully interact with them (Andrews *et al.*, 2019).

Loneliness, a significant psychosocial challenge among older adults, was found to be relatively low or moderate in most participants. This suggests that the senior home residents had a sufficient level of social connectedness and support. Social isolation and loneliness are known barriers to technology adoption among older adults, as they may contribute to a lack of motivation or interest in using technology, while also leading to less available support for technology-related issues (Kamin *et al.*, 2020). The relatively low levels of loneliness observed in this study might have thus positively influenced the participants' perception of technology.

The assessment of health-related quality of life revealed that most participants did not face significant difficulties in self-care and daily activities. However, a notable proportion reported problems related to pain/discomfort and mobility. These findings highlight the importance of incorporating

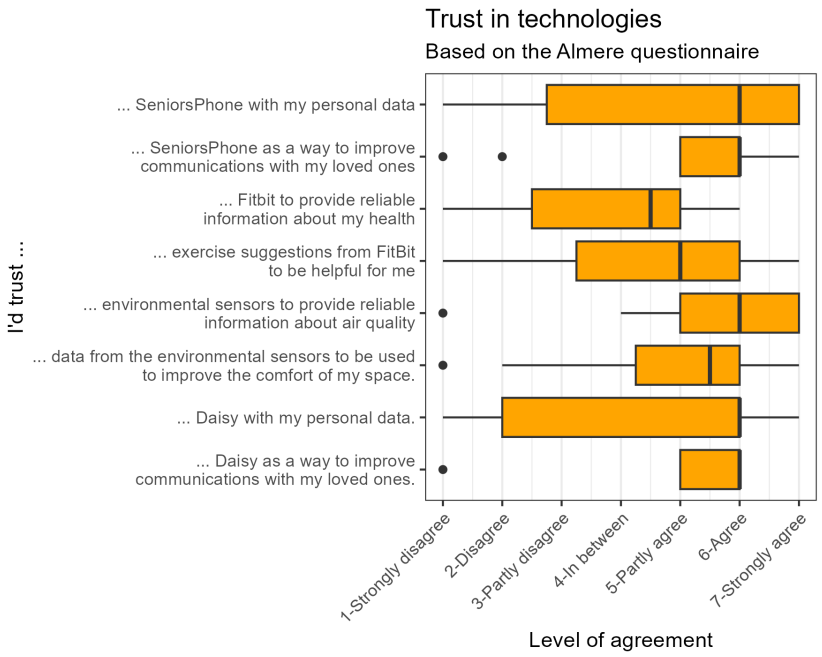

Figure 5. Older adults tend to report high trust in tested technologies.

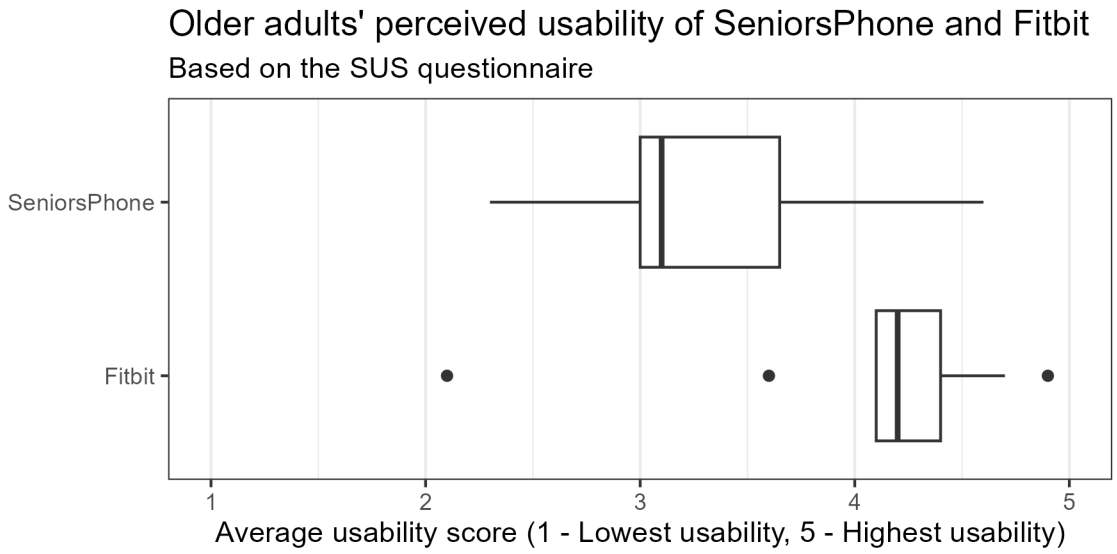

Figure 6. The usability of SeniorsPhone was rated with middle values, while the Fitbit was rated higher.

technologies that address physical well-being and specific needs and provide support for managing pain and improving mobility (Thielke *et al.*, 2012). Technologies such as the smartwatch used in the study, which monitored health metrics and provided real-time feedback, could play an important role in promoting self-awareness and facilitating healthier lifestyle choices among older adults.

The perception of the tested technologies was generally positive among the participants, who reported high trust in technologies and perceived them as usable. Trust in technology is a critical factor influencing adoption, as older adults need to feel confident that their personal data is protected, and that the technology is reliable (Kamin *et al.*, 2020). The finding that older adults in our study trusted the technologies

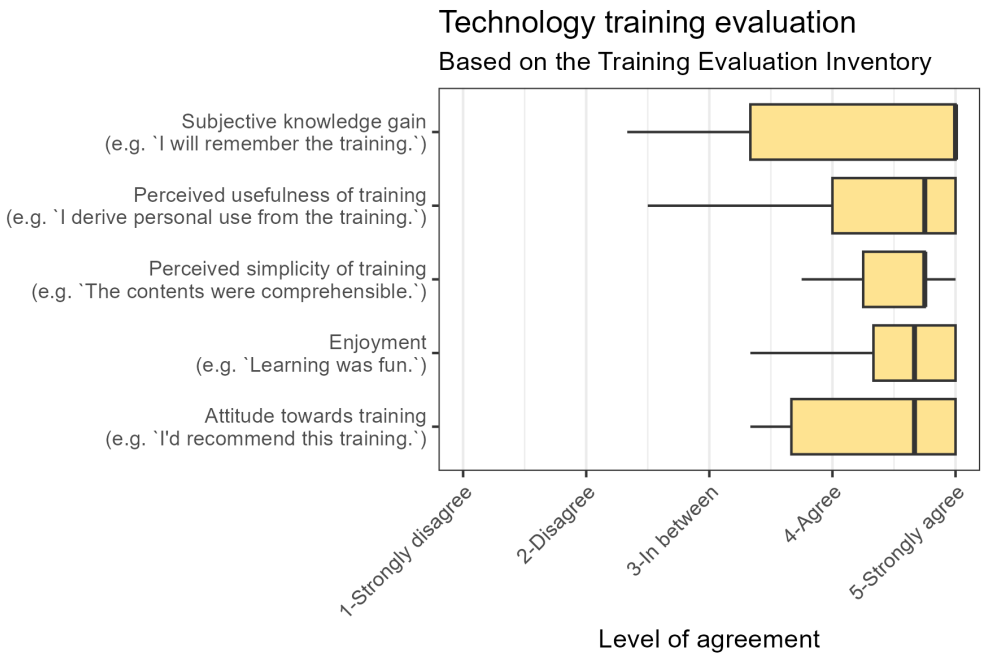

Figure 7. **Participants were generally satisfied with the technology training they received.**

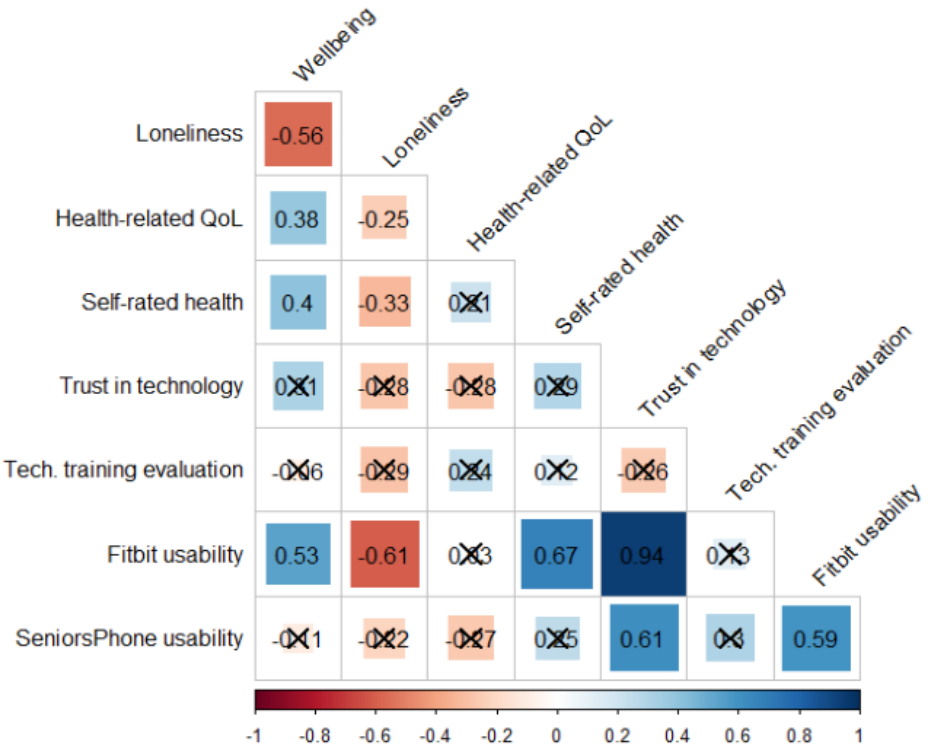

Figure 8. **Health and wellbeing variables correlated with each other; the same was true for technology variables.**

and perceived them as useful is promising, as it suggests readiness to embrace technological solutions that promote well-being and independence.

Usability, an essential aspect of technology acceptance, was rated satisfactorily for the SeniorsPhone and even higher for the Fitbit. The positive perception of usability indicates that the technologies were perceived as accessible and beneficial. These findings highlight the value of designing user-friendly interfaces, and providing adequate training and support to ensure a positive user experience (Bixter *et al.*, 2018).

The correlations between evaluated variables revealed an interesting association. Higher levels of wellbeing and lower level of loneliness were associated with higher ratings of the Fitbit usability. This suggests that older adults with higher levels of well-being may be more receptive to adoption of at least some technologies, and more likely to perceive these technologies as beneficial.

In conclusion, the findings indicate that Slovenian senior home residents without significant cognitive issues generally report average or high levels of well-being, low or moderate levels of loneliness, and typically do not face significant difficulties in self-care and daily activities. The participants perceived the tested technologies positively, generally viewing them as trustworthy and usable. Interestingly, individuals with higher levels of well-being and lower levels of loneliness seem more likely to perceive at least some technologies as more usable. These findings highlight the importance of considering individual psychosocial characteristics when designing and implementing technology interventions for older adults.

Limitations

Our study's primary limitation is the generalizability of the findings due to its exclusive focus on three coastal senior homes in different towns within Slovenia. These specific locations may attract individuals with varying socio-economic and health statuses, potentially differing significantly from senior home residents in other regions of the country and other countries. Consequently, the results may not fully represent the broader population of senior home residents. Additionally, we did not evaluate the cognitive status of participants with objective tests, so we may have excluded some participants unfairly (based on the opinion of the senior home staff).

Data availability

Zenodo: Data analysis for "Wellbeing, loneliness, health-related quality of life and perception of technology of older adults in Slovenian senior homes". https://doi.org/10.5281/zenodo.8252316. (Lipovac & Erce, 2023)

This project contains the following underlying data:

- TEI.xlsx. (Technology Evaluation Inventory data.)
- TIT.xlsx. (Trust in technologies data.)
- expgroup_WHO5_UCLA_EQ_SUS.xlsx (data on WHO-5, UCLA, EQ, and SUS)
- data_analysis_slo_senior_homes.pdf
- data_analysis_slo_senior_homes.rmd

Extended data

This project contains the following extended data:

- questionnaires_english.docx
- questionnaires_slovenian.docx

Data are available under the terms of the Creative Commons Attribution 4.0 International Public License.

Acknowledgements

We are grateful to Michael D. Burnard for support in development of the study and Andreja Kutnar for reading the article and providing comments.

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Open Peer Review

Current Peer Review Status: ✔ ?

Version 1

Reviewer Report 22 July 2024

https://doi.org/10.21956/openreseurope.17493.r41407

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Luc de Witte
The Hague University of Applied Sciences, The Hague, South Holland, The Netherlands

This article presents the results of a study into experienced loneliness, wellbeing and health-related quality of life and the opinions on a few often used technologies among a group of 73 older adults living in senior homes in Slovenia. The article is generally well written and the topic is relevant and timely. Technology will (have to) play a major role in care and support of older adults with care needs in many countries, so it is good to study how technology is perceived and how it can contribute to independence and quality of life of older adults. So far so good. The article, however, raises some serious questions about the generalisability of the findings and its relevance for future policies.

The first concern regards the study population. The participants are people living in senior homes, but it is not described what senior homes are exactly and what kind of people live there. The findings show that the participants experience very few problems in their daily lives, which raises the question how representative this population is for older adults in general. From other research we know that many older adults do experience problems, which may lead to very different perceptions of the relevance of technology. This point should at least be discussed in the discussion section.

A second concern is the choice of technologies involved in the study. Why these technologies? Is there as practical or theoretical reasoning behind this choice? Are these the most relevant from the perspective of care and support needs? The selection looks a bit 'random'. I would expect some reflection about this in the discussion section.

The third concern regards the quite limited level of detail about the study procedures. How where participants selected; did they all receive all 4 technologies; was there a match with experienced needs of interests, or did everyone just get the same; how was the training done (5 minutes per participant seems very little to optimally use the potential of the technology)? There are examples of question coming up when reading the paper. A bit more detail would help to assess the relevance of the work.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

Are all the source data and materials underlying the results available?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Technology for health and social care, with a focus on long term care

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 07 May 2024

https://doi.org/10.21956/openreseurope.17493.r37264

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Rozeta Draghici
Research Laboratory of Social Gerontology and GerontoPsycholology, National Institute of Gerontology and Geriatrics “Ana Aslan”, Bucharest, Romania
Alexandra Rusu
Research Laboratory of Social Gerontology and GerontoPsycholology, National Institute of Gerontology and Geriatrics “Ana Aslan”, Bucharest, Romania, Bucharest, Romania, Romania

The paper “**Wellbeing, loneliness, health-related quality of life and perception of technology of older adults in Slovenian senior homes: a cross-sectional study”** by Lipovac and Erce (2023) presents findings from a study conducted in three Slovenian senior homes, examining the levels of wellbeing, loneliness, health- related quality of life, and perceptions of using certain technology among 73 older adults without significant cognitive issues.

The authors provided access to their data, thus making the results reproducible, which is an applauding effort as it promotes the principles of open science.
The clarity of writing and the structure of the paper represent the aspects that need some tweaking:

1. Introduction is quite short. The last paragraph needs to be completed. Did you mention any studies about the link between the variables and the perception of technologies? Mention the hypotheses at the end of the introduction.
2. Methods. It's important to be very specific in this section, for example you mentioned that "they were predominant female... (How many?)"; "While most participants..." (How many?); "Several questionnaires were administered to assess different aspects..." (Like what? Research items? Tests scored?).
3. Results. Describe the exact number of participants and all findings in Figures 1-4. It's no clear "Association between variables on health, wellbeing, loneliness, health-related quality of life, and variables related to technology", there are only two technologies described in Figure 8 (Exact p values?).
4. Discussion. In your results you only talk about Fitbit and Seniors Phone, but at the very beginning, you said that were tested four technologies. Where are those other two?!
5. Limitations. The last paragraph needs to be completed. How could the results be impacted based on the cognitive status? Maybe you can add these information in participants description or maybe you can let a door closed for further studies.

The paper shows good scientific efforts. With some minor improvements, we believe your efforts will be even more obvious to the reader and thus, more appreciated. Really nice example to offer so that more researcher will share their data openly!
We wish you the best of luck with your research!

Is the work clearly and accurately presented and does it engage with the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

Are all the source data and materials underlying the results available?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Gerontopsychology, Social Gerontology, Clinical Psychology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.