Use of Digital Technology Among Older Adults in Poland With Near Visual Impairment

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Table of Contents

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Abstract

Background: The rapid evolution of digital technologies has transformed many aspects of daily life, offering substantial benefits for health and well-being through telemedicine and telehealth services. However, disparities in access to these technologies, particularly among older adults with visual impairments, remain a significant concern.

Objective: This study aimed to examine the differences in access to and use of digital technologies between older adults in Poland with near visual impairment and those without.

Methods: This cross-sectional analysis utilized data from the PolSenior2 project, a nationwide, multicenter survey conducted between 2018 and 2019. The sample included 5,872 community-dwelling Polish adults aged 60 and older, selected using a random, three-stage, proportional sampling method, stratified by age and sex. Self-reported data on access to and usage of digital technologies, including smartphones, computers, and internet access, were collected. Near visual acuity was assessed using the Snellen chart for near vision.

Results: Older adults with near visual impairment had significantly lower odds of owning and using digital devices compared to those without visual impairment. Specifically, the odds of having and knowing how to use a smartphone (OR 0.62, 95% CI 0.46-0.84), a computer (OR 0.65, 95% CI 0.50-0.86), and having internet access (OR 0.64, 95% CI 0.48-0.83) were notably lower among individuals with near visual impairment. Furthermore, these individuals were less likely to use the internet for tasks such as searching for information about goods and services (OR 0.65, 95% CI 0.49-0.86).

Conclusions: Older adults with near visual impairment in Poland face significant barriers in accessing and using digital technologies. These disparities highlight the need for targeted interventions to bridge the digital divide and improve digital inclusion for visually impaired seniors, ensuring they can benefit from the advantages of digital health solutions. Further research is required to develop and evaluate strategies to promote digital equity in this vulnerable population.

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Conclusions:

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Keywords: digital inclusion, telemedicine, telehealth, visual impairment, older adults, technology access, Poland

1. Introduction

Globally, the swift progression of digital technology has significantly influenced various aspects of daily life, providing a multitude of benefits and conveniences.

According to the World Health Organization (WHO) these advancements include improved health and well-being through the use of digital health services, often referred to as telemedicine or telehealth, which have become increasingly important (1). Gell, Rosenberg, et al. (2015) found in their study that access to and use of digital technology can vary greatly among different population groups, particularly older adults and individuals with disabilities (2).

Furthermore, elderly individuals with visual impairments encounter distinct challenges in accessing and utilizing digital technologies, potentially exacerbating disparities in digital inclusion (2,3). Additionally, findings from a cross-sectional study indicate that older adults with visual impairments in the United States are less likely to have access to digital technology (3).

Numerous global studies indicate that this lack of access can result in increased isolation and diminished opportunities for these individuals to benefit from online services and resources that could improve their quality of life (4,5,6).

Poland is a country where numerous older adults encounter challenges related to digital technology. Only 33.4 % of people over 65 in Poland use a smartphone, according to the National Media Institute (2022), and 13.8 % of older people use a laptop or notebook (7). According to Pietrzyk, Mazurek - Kucharska, & Wysokinska (2024) individuals aged 65 and older in Poland are generally poorly

prepared to use the internet. It is typically their children and grandchildren who assist them in using this medium, which would otherwise be beyond their reach (8). A lack of basic user knowledge remains the main barrier for individuals over the age of 65 who are willing to engage in meaningful interactions or make use of online services (8).

Despite these challenges, there is no research specifically examining the use of digital technology by visually impaired older adults in Poland. This gap in the literature underscores the need for further investigation. Thus, the aim of this study was to identify discrepancies in digital technology access for older adults with near visual impairments compared to their peers without near visual impairments using national data. By understanding these discrepancies, we can better address the unique needs of visually impaired older adults in Poland and work towards greater digital inclusion for all.

2. Methodology

2.1 Data sources

The PolSenior2 project is a nationwide, multicenter, cross-sectional study carried out between 2018 and 2019. To ensure the representativeness of the older adult population in Poland, a random, three-stage, proportional sampling method was employed. This method, stratified by age and sex, facilitated the selection of 5987 Polish community-dwelling adults aged 60 years and above. Further details regarding the methodology are provided in another publication (9).

The study protocol encompassed the utilization of three paper-based questionnaires, specialized geriatric tests, anthropometric and blood pressure measurements, and analyses of blood and urine samples. Trained nurses administered the medical and socioeconomic parts of the questionnaire via face-to-face interviews conducted during three home visits with the participants. Moreover, specific data points were obtained from the self-administered part of the questionnaire, completed autonomously by the respondents. All participants involved in the study provided written informed consent before their inclusion. The study protocol received approval from the Bioethics Committee of the Medical University of Gdansk (NKBBN/257/2017).

Initial ophthalmological screenings were conducted during the first visit as part of the medical section of the questionnaire, while data regarding digital technology usage were collected during the second visit as part of the socioeconomic section of the questionnaire. Data from 5872 subjects were gathered and analyzed. A small fraction of respondents (1.9%) were excluded due to missing data.

However, the absence of this information appeared to be random.

2.2 Digital Technology Access

To assess whether individuals have and know how to use a cellphone, computer, internet, and smartphone, two questions were asked: 1. Is your household equipped with the above-mentioned devices or services? 2. Do you use these devices or services?

To determine the purpose of internet usage, we asked individuals to select one of the following options:

1. sending/receiving mails

2. searching for information (e.g., about goods, services)

3. use of online banking

4. use of instant messaging-e.g. Skype, Facetime, Microsoft Messenger

5. participating in chat rooms and using social networking sites e.g. Facebook

6. searching for healthcare information

7. shopping online, ordering tickets, e.g., cinema, theater, train, airline tickets

8. government websites for electronic handling of government inquiries (e-administration)

2.3 Near visual impairment

Binocular near visual acuity (VA) with habitual correction were measured using the Snellen chart for near vision. This chart consisted of eight sections of text with gradually increasing the font size, marked from 1 (smallest print) to 8 (largest font). Functional near vision was measured at each participant's preferred distance. For illiterate individuals, an "E" chart was utilized.

Based on the above data, respondents were categorized into the following groups:

1. Normal near vision: including individuals who could read lines 1–4 from the standard distance (30-40 centimetres).
2. Near visual impairment: including individuals who could not read lines 1–4 from the standard distance (<30 cm or >40 cm), or read verses 5–8 from any distance, or were unable to read

any verses.

2.4 Other Variables

Data on age, sex, living arrangement (alone/with others), place of residence (rural area or city with <20,000 population/larger city, education, household financial situation, and number of comorbidities were also collected.

To determine the subjects' education level, the respondents were asked “What is your current education level?”. The possible answers were (1) no education, (2) incomplete primary education, (3) primary education, (4) middle school, (5) vocational high school, (6) high school, (7) 2-year college, (8) bachelor’s degree, “engineer’s degree”, and (9) master's degree. To simplify the analysis, education levels (1)-(3) were classified as "primary or incomplete primary", (4)-(6) were classified as “middle”, and (7)-(9) were classified as "higher".

The financial situation of the household was assessed with the following question: “Which of the following sentences best describes the financial situation of your household?” The possible answers were (1) “We live comfortably without having to save for special purchases”, (2) “We live frugally and we have enough to cover all of our expenses;”, (3) “We need to put money aside to save for special purchases”, (4) “We have enough money for basic needs such as food and clothing”, (5) “We only have enough money for food”, and (6) “We don’t have enough money even to meet our basic needs.” For consistency of the results, the responses were grouped into respective categories: Can easily afford everything (1), Can afford everything but only when saving (2), and Self-reported poverty (3)(4)(5)(6).

We also considered comorbid conditions, including heart attack, heart failure, arterial hypertension, diabetes, stroke, dementia, chronic obstructive airway disease and cancer, to get a better assess each group.

Diabetes mellitus was noted when a patient declared that it was previously diagnosed, or if fasting glucose was ≥126 mg/dL, or if the use of hypoglycemic drugs was reported.

Hypertension was diagnosed if the average blood pressure values from two measurements during each visit were equal to or greater than 140 mmHg (systolic blood pressure) and/or 90 mmHg (diastolic blood pressure) or if the patient was taking hypotensive drugs over the past 2 weeks because of an earlier diagnosis of hypertension.

We assessed dementia using the Mini–Mental State Examination (MMSE) with the Mungas correction. Participants scoring 23 points or less on the MMSE were classified as having dementia.

Comorbidities, including heart attack, heart failure, chronic obstructive pulmonary disease, and cancer, were identified based on self-reported data. Additionally, heart failure was verified through medical documentation.

2.5 Statistical Analysis

Statistical analyses were performed using SAS 9.4 TS Level 1M5 (SAS Institute, Cary, NC, USA) and the R version 3.6.3 R (R Foundation for Statistical Computing, Vienna, Austria). The results were presented as percentages or percentages with 95% confidence intervals. To compare the proportions, the chi-square test was applied. Sampling weights were included in statistical calculations to account for the complex survey design using R survey package. The post-stratification procedure was used to match age–sex sample distribution to the population of Poland. A multivariable logistic regression models were created to identify associations of near visual impairment with technological environment outcomes. Every model was adjusted for age, sex, living arrangements, education, comorbidities and income. In our models we also included interaction effects (jeśli ostatecznie będziemy z tego korzystać). For all statistical analyses, the level of significance was set at 0.05.

3. Results

A total of 2,738 out of 5,872 participants (46.63%) exhibited near visual impairment (Table 1). The mean age of individuals with near visual impairment was 76.8 years, which is higher than the mean age of 73.1 years for those without such impairment (Table 1). Furthermore, adults with near visual impairment were less likely to have attained middle or higher education levels compared to their counterparts without near visual impairment. Additionally, respondents with near visual impairment reported higher rates of comorbidities and more frequently experienced poverty compared to those without the impairment (Table 1).

Other variables, including sex and living arrangement were comparable between the two groups (those with near visual impairment and those without near visual impairment) (Table 1).

Table 1. Demographics and Characteristics by Near Visual Impairment Status.

	Near Visual Impairment (N=2738)	Normal vision (N=3134)	*P*-value
Age			<.001
Mean	76.843	73.098	
Sex			.601
Overall	2738	3134	
Women	1380 (50.4%)	1602 (51.1%)	
Men	1358 (49.6%)	1532 (48.9%)	
Living arrangements			.819
Overall	2598	3007	
With others	2042 (78.6%)	2371 (78.8%)	
Alone	556 (21.4%)	636 (21.2%)	
Education			<.001
Overall	2684	3071	
Higher	384 (14.3%)	617 (20.1%)	
Middle	1327 (49.4%)	1778 (57.9%)	
Primary	973 (36.3%)	676 (22.0%)	
Comorbidities			<.001
Overall	2588	3067	
0-1	1105 (42.7%)	1597 (52.1%)	
2	794 (30.7%)	864 (28.2%)	
3	417 (16.1%)	397 (12.9%)	
>= 4	272 (10.5%)	209 (6.8%)	
Income			.022

	Near Visual Impairment (N=2738)	Normal vision (N=3134)	*P*-value
Overall	2624	3045	
Can easily afford everything	478 (18.2%)	595 (19.5%)	
Can afford everything but only when saving	1393 (53.1%)	1674 (55.0%)	
Self-reported poverty	753 (28.7%)	776 (25.5%)	

The prevalence of having and knowing how to use cell phones, smartphones, computers, and access to the internet was lower among older adults with near visual impairment compared to their peers without VI (Table 2). Furthermore, in terms of the various purposes of internet usage, individuals with near visual impairment exhibited a lower engagement in every type of digital experience (Table 2).

Table 2. Weighted Prevalence of Technological Environment Outcomes by Near Visual Impairment Status

	Near Visual Impairment (%,CI)	Normal vision(%,CI)
Has and knows how to use the following		
Cellphone	80.9 (78.3-83.5)	89.2 (86.6-91.7)
Smartphone	15.7 (12.3-19)	27.5 (23.9-31)
Computer	36.9 (33.2-40.5)	51.5 (47.4-55.5)
Internet Access	38.0 (34.2-41.8)	53.6 (49.2-58.0)
Internet activities		
sending/receiving mails	15.2 (12.4-18.1)	26.0 (21.9-30.1)
searching for information (e.g., about goods, services)	25.6 (22.1-29.1)	40.8 (36.0-45.6)
use of online banking	13.0 (10.6-15.4)	23.6 (20.0-27.3)
use of instant messaging e.g. Skype, Facetime, Microsoft Messenger	11.0 (8.8-13.2)	16.5 (13.7-19.3)
participating in chat rooms and using social networking sites e.g. Facebook	5.9 (4.5-7.3)	10.6 (8.1-13.0)
searching for healthcare information	15.9 (13.4-18.5)	25.4 (22.3-28.6)

shopping online, ordering tickets, e.g., cinema, theater, train, airline tickets	6.2 (4.7-7.8)	13.5 (11.1-15.9)
government websites for electronic handling of government inquiries (e-administration	4.0 (2.7-5.3)	8.3 (5.8-10.7)

In a multivariable logistic regression analysis (Table 3), near visual impairment was associated with lower odds of having and knowing how to use a smartphone (OR, 0.62; 95% CI, 0.46-0.84), a computer (OR, 0.65; 95% CI, 0.50-0.86), and access to the internet (OR, 0.64; 95% CI, 0.48-0.83) compared with no visual impairment. Near visual impairment was also associated with lower odds of using the internet for searching for information (e.g., about goods and services) (OR, 0.65; 95% CI, 0.49-0.86) compared with no visual impairment. No other associations were noted between near visual impairment status and digital experiences, such as sending/receiving emails,online banking, searching for healthcare information, using instant messaging (e.g., Skype, Facetime, Microsoft Messenger), participating in chat rooms, using social networking sites (e.g., Facebook), shopping online or ordering tickets(e.g. cinema, theater, train, airline, tickets) or using government websites for electronic handling of government inquiries (e-administration). (Table 3).

Table 3. Multivariable Logistic Regression: Associations of Near Visual Impairment
With Technological Environment Outcomes

	Adjusted OR (95% CI)	*P*-value
Has and knows how to use the following		
Cellphone	0.81(0.56 to 1,17)	.263
Smartphone	0.62 (0.46 to 0.84)	.002
Computer	0.65 (0.50 to 0.86)	.002
Internet Access	0.64 (0.48 to 0.83)	.001
Internet activities		
sending/receiving mails	0.73 (0.53 to 1,0)	.005
searching for information (e.g., about goods, services)	0.65 (0.49 to 0.86)	.002
use of online banking	0.81 (0.58 to 0.1,13)	.223
use of instant messaging e.g. Skype, Facetime, Microsoft Messenger	1,04 (0.74 to 1.47)	.813
participating in chat rooms	0.96 (0.62 to 1.48)	.855

and using social networking sites e.g. Facebook		
searching for healthcare information	0.81 (0.60 to 1,09)	.168
shopping online, ordering tickets, e.g., cinema, theater, train, airline tickets	0.96 (0.65 to 1,43)	.859
government websites for electronic handling of government inquiries (e-administration	0.84 (0.52 to 1.35)	.465

The impact of near visual impairment on internet access among older adults in Poland was significant. The findings indicated that the odds of using the internet were substantially lower for individuals residing in rural areas or cities with populations under 20,000. This was demonstrated by the interaction term for near visual impairment and place of residence (rural area or city with <20,000 population), which yielded an odds ratio (OR) of 1.41 (95% CI: 1.06-1.87, *P*-value = .019). Similarly, the interaction between near visual impairment and place of residence significantly affected the odds of searching for information. Specifically, near visual impairment reduced the odds of searching for information more among individuals living in villages or cities with populations less than 20,000, compared to those in larger cities, and this result was statistically significant (OR = 1.44, 95% CI = 1.06-1.97, *P*-value =.021). Conversely, near visual impairment increases the odds of online shopping more among individuals living in rural areas or cities with populations less than 20,000 compared to those in larger cities (Interaction term: Near visual impairment x Place of residence – village or city with <20,000 population, OR = 0.60, 95% CI = 0.37-0.99, *P*-value =.045). Furthermore, the interaction between near visual impairment and education level was statistically significant for both searching for health information and online banking. Specifically, near visual impairment reduced the odds of searching for health information less among those with primary education compared to those with higher education (OR = 0.62, 95% CI = 0.43-0.90, *P*-value = .014). Similarly, the interaction between near visual impairment and educational level significantly affected the odds of online banking. Near visual impairment reduced the odds of engaging in online banking less among those with primary education compared to those with higher education (OR = 0.55, 95% CI = 0.32-0.95, *P*-value =.030). The analysis indicated that there were no statistically significant interactions between visual impairment and socioeconomic factors, such as sex and living arrangements, in relation to any aspect of digital technology access considered in our study.

4. Discussion

The findings from our study revealed significant associations between near visual impairment and decreased digital engagement among older adults in Poland. Older adults with near visual impairment were less likely to own and know how to use smartphones, computers, and access to the internet. This trend extended to digital experiences, where those with near visual impairment engaged less frequently in internet activities such as searching for information (e.g., about goods and services).

However, the multivariable logistic regression analysis showed lack of association between near visual impairment and the use of instant messaging, sending/receiving emails, online banking, searching for healthcare information, participation in chat rooms, social networking , shopping online or ordering tickets or, or accessing government websites for e-administration. This may suggest that certain digital activities might be less influenced by visual impairment, possibly due to the availability of assistive technologies or the lower complexity of these tasks.

Moreover, our findings were consistent with international research, demonstrating that elderly individuals, especially those with disabilities, encounter substantial obstacles in accessing digital technology.(2,3,10,11) A study conducted in the United States reported even greater disparities, with near visual impairment being associated with lower odds of having and knowing how to use a cell phone (OR, 0.56; 95% CI, 0.36-0.87), a computer (OR, 0.57; 95% CI, 0.44-0.75), or a tablet (OR, 0.65; 95% CI, 0.52-0.81), sending messages by email or text (OR,0.56; 95%CI,0.40-0.77), and going online besides sending an email or text (OR, 0.59; 95%CI, 0.44-0.80) compared to those without near visual impairment. (3). Near visual impairment, however, was not associated with any digital health– or nonhealth-related experiences such as visiting social network sites, visiting with family or friends on video calls. (3) Also, other study from the United States showed that impairments in vision were associated with decreased usage of an e-mail and text messaging and the internet(2).

Research conducted in Sweden revealed that participants with visual impairments reported lower usage of digital identification and a tendency to avoid booking healthcare appointments online compared to participants without visual impairments and those with other types of impairments, such as neurological, musculoskeletal, or hearing impairments (10).

According to many studies, visual impairments pose substantial barriers to digital inclusion, limiting the ability of affected individuals to benefit from online resources and services.(2,3,10,11) Barriers include policies that do not explicitly support accessible design, webpage designs that are incompatible with assistive devices, and insufficient financial resources to acquire appropriate assistive technology (12).

However, other studies indicate that, contrary to common misconceptions, modern smartphones are highly accessible to visually impaired individuals. They offer advanced features such as sound, haptics, gestures, high contrast ratios for colors, and the ability to increase text size by at least 200%.. (13,14,15,16,17)This underscores the need for enhanced awareness and training among healthcare professionals, educators, and the general public to fully utilize these capabilities (13,14,15). One study indicate that 20% of visually impaired elderly were aware of the existence of assistive technology, while only about 8% had a good knowledge of how to use them.(18)

Additionally, our results highlighted significant interaction effects between near visual impairment and both place of residence and education level on various online activities, indicating that the barriers posed by visual impairment were compounded by certain sociodemographic factors. It significantly reduced the odds of accessing the internet and searching for information more in smaller communities (<20,000 population) compared to larger ones. Conversely, its impact on online shopping was less evident in smaller communities. Visually impaired individuals often face significant challenges in accessing and navigating physical stores. (19), especially those residing in rural areas and small towns. This demographic is particularly disadvantaged due to the limited availability of retail establishments in those regions, compounded by the difficulties they encounter within store environments. Consequently, there is a heightened demand for online shopping among this group. The convenience and accessibility of e-commerce platforms provide a vital alternative, enabling visually impaired persons to procure necessary goods and services without the obstacles associated with traditional brick-and-mortar stores. This reliance on online shopping underscores the need for inclusive digital solutions that cater to their specific needs and preferences. This seems to be a global situation. For example, one study [20] showed that online shopping is an integral component of the daily lives of people with disabilities in China, particularly for the visually impaired.. However, another study showed that rural areas often lack the necessary infrastructure and reliable internet connectivity, posing significant challenges for residents in accessing digital resources and services.(21) This digital divide hinders the ability of rural inhabitants to benefit from online platforms, further exacerbating the difficulties faced by visually impaired individuals in these regions. However, according to the GUS, a Polish Census Bureau, the penetration of internet access is quite hight in all Poland, reaching 93,3% of households in 2022, with the almost even spread among cities and rural areas: big cities: 94,4%, small cities: 92,3% and rural areas: 93,2% (22,23).

Strength and Limitations

The strengths of this study include a large, representative sample and a comprehensive assessment of access and usage of digital technology. However, several limitations should be noted. Firstly, the

cross-sectional design precludes causal inferences regarding the relationship between visual impairment and digital technology usage. Secondly, data collection was conducted prior to the COVID-19 pandemic. Additionally, our study did not assess distance visual impairment.

Conclusions

In Poland, older adults with near visual impairment encounter substantial challenges in accessing and utilizing digital technologies. Addressing these disparities is essential to foster greater digital inclusion to improve the quality of life for visually impaired older adults in the country.

There is the need for targeted interventions to enhance digital inclusion for older adults with near visual impairment in Poland. Efforts should focus on improving digital literacy, enhancing the accessibility of digital devices and services, and providing tailored support to visually impaired individuals. Such initiatives are essential to ensure that all older adults can fully participate in the increasingly digital society, thereby enhancing their quality of life and reducing social isolation. Further research is needed to explore the specific barriers faced by visually impaired older adults and to develop effective strategies to bridge the digital divide.

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Contribution statement

All authors made substantial contributions to this work. AL,BW,TZ conceived the concept of the study; AL,NL,KJ designed the study, acquired the data, and performed the analyses; AL, NL, BW, and TZ interpreted the data. AL and NL wrote the manuscript. AL, NL, BW, CR, and TZ substantially revised the manuscript. All authors have read and approved the published version of the manuscript.

Conflict of interest

None declared.

Data Availability

All data generated or analysed during this study are included in this published article.

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