Original article

Digital literacy and technological profile of coronary patients: mobile applications for health education*

Letramento digital e perfil tecnológico de pacientes coronarianos: aplicativos móveis para educação em saúde

Alfabetización digital y perfil tecnológico de pacientes coronarios: aplicaciones móviles para la educación en salud

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Abstract

Objective: To evaluate digital health literacy and delineate the technological profile of patients with coronary artery disease. **Method**: A cross-sectional, descriptive, and exploratory study was conducted. Data collection was conducted at an outpatient clinic of a university hospital from July 2022 to March 2023. A validated and adapted instrument was used to outline the technological profile, and the eHEALS scale was employed to assess digital literacy. **Results**: The level of digital health literacy found was low. In the technological profile, the smartphone emerged as the most used device in daily life. Most participants had Wi-Fi internet access (82, 60.3%), and 112 (82.4%) expressed interest in using an application about their disease. **Conclusion**: The digital health literacy observed was insufficient. Coronary patients prefer the use of smartphones. Educational mobile applications tailored to the elderly population can be utilized as a strategy to enable digital inclusion.

Descriptors: Health Literacy; Digital Health; Coronary Disease; Health Education; Health Profile

Resumo

Objetivo: avaliar o letramento digital em saúde e traçar o perfil tecnológico dos pacientes com doença arterial coronariana. **Método**: estudo transversal, descritivo e exploratório. A coleta foi realizada no ambulatório de um hospital universitário no período de julho de 2022 a março de 2023. Utilizou-se um instrumento validado e adaptado para traçar o perfil tecnológico e a escala *eHEALS* para avaliação do letramento digital. **Resultados**: o nível de letramento em saúde digital encontrado foi baixo. No perfil tecnológico, o *smartphone* se apresentou como o dispositivo mais utilizado no cotidiano. A maioria dos participantes possuía o acesso à internet *Wifi* com 82 (60,3%) e 112 (82,4%) sinalizou o interesse em utilizar um aplicativo sobre sua doença.

Conclusão: o letramento em saúde digital encontrado mostrou-se insuficiente. Os pacientes coronarianos preferem o uso de *smartphone*. Aplicativos móveis educativos adequados a população idosa podem ser utilizadas como estratégia para permitir a inclusão digital.
Descritores: Letramento em Saúde; Saúde Digital; Doença das Coronárias; Educação em Saúde; Perfil de Saúde

Resumen

Objetivo: Evaluar la alfabetización digital en salud y delinear el perfil tecnológico de pacientes con enfermedad coronaria. **Método**: Estudio transversal, descriptivo y exploratorio. La recopilación de datos se llevó a cabo en una consulta ambulatoria de un hospital universitario desde julio de 2022 hasta marzo de 2023. Se utilizó un instrumento validado y adaptado para perfilar el perfil tecnológico, y la escala eHEALS se empleó para evaluar la alfabetización digital. **Resultados**: El nivel de alfabetización digital fue bajo. En el perfil tecnológico, el smartphone surgió como el dispositivo más utilizado en la vida diaria. La mayoría de los participantes tenía acceso a internet Wi-Fi (82, 60.3%), y 112 (82.4%) expresaron interés en utilizar una aplicación sobre su enfermedad. **Conclusión**: La alfabetización digital en salud fue insuficiente. Los pacientes coronarios prefieren el uso de smartphones. Las aplicaciones móviles educativas adaptadas a la población anciana pueden utilizarse para habilitar la inclusión digital.
Descriptores: Alfabetización en Salud; Salud Digital; Enfermedad Coronaria; Educación en Salud; Perfil de Salud

Introduction

The World Health Organization's current definition of health literacy (HL) encompasses the knowledge and skills acquired through daily activities, social interactions, and intergenerational exchanges.[1] These aspects are shaped by organizational structures and the availability of resources, ease of access, comprehension, evaluation, and the utilization of information and services to promote and preserve one's own health and the well-being of the surrounding community.[1] Deficient health literacy is a public health concern that yields adverse consequences for individuals' health.[2]

Low HL is associated with poorer health outcomes, including increased hospital admissions, emergency service utilization, poor medication adherence, and elevated mortality rates. Additionally, patients with low HL encounter greater difficulty in comprehending health information, possess less knowledge about their condition, receive diminished support in discussing health problems, experience discomfort in communicating with healthcare professionals, and hesitate to ask questions to clarify received information.[3]

Elevated levels of HL correlate with improved health self-management indicators, such as adherence to a healthy lifestyle and lower rates of obesity, smoking, and hospital readmission.[3] Inadequate HL is recognized as an impediment to maintaining health and preventing coronary artery disease (CAD), and it is associated with the failure to adopt self-care behaviors for disease management.[3]

Health education is of significant value in the treatment of coronary disease, focusing on strategies that empower individuals to make informed health decisions, leading to positive health outcomes. The educational process is complex, involving diverse dimensions such as attitudinal change, disease knowledge, and, notably, individual autonomy. When aligned with HL, it fosters the necessary empowerment for individuals to make conscious choices.[4-5]

For nursing, health education is a pivotal guiding principle of practice, directly linked to the quality of care provided. Implementing educational practices tailored to patients' realities promotes knowledge exchange between nurses and patients, fosters the development of critical awareness, and individualizes care delivery.[4]

Technological resources are valuable assets in the health education process, facilitating information exchange between educators and media users and simplifying access to health content and services. Through electronic health literacy (eHealth), individuals can acquire and utilize knowledge to guide attitudes and decisions regarding their health. However, the effective use of digital tools depends on an individual's ability to critically employ these resources, appropriately process scientific information, and filter reliable sources for health-related decision-making.[6]

Digital health literacy is defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to address or solve a health problem".[7] The utilization and development of online health information can aid in meeting the health demands of older adults.

Nevertheless, older adults exhibit vulnerability regarding digital health literacy capacity, due to lower internet usage rates compared to other adults. It is also notable that, generally, they possess less familiarity with digital tools, which can lead to a deficiency in the ability to search, understand, analyze, and evaluate media content, including the reliability of online news.[8] The objective of this study is to

evaluate digital health literacy and delineate the technological profile of patients with coronary artery disease.

Method

This study employs a cross-sectional, descriptive, and exploratory design. It was conducted in the cardiology and hemodynamics outpatient clinic of a university hospital in Recife, Pernambuco (PE), Brazil. Data collection occurred from July 2022 to March 2023, utilizing a validated data collection instrument,[9] administered by the researcher and an undergraduate nursing student, who received training through dialogic exposition and field data collection monitoring by the researcher.

The instrument was administered via semi-structured interviews, conducted individually in a private consultation room, addressing questions related to sociodemographic profiles (age, marital status, education) and technological profiles (type of mobile device, application usage, internet connection quality).

Digital health literacy was measured using the eHEALS scale, an eight-item instrument designed to assess individuals' perceived knowledge, comfort, and skills in finding, evaluating, and applying electronic health information to health problems.[10]

Inclusion criteria were defined as patients who underwent cardiac catheterization or coronary angioplasty and were receiving pharmacologic treatment for coronary artery disease. Exclusion criteria comprised those who underwent myocardial revascularization and those with visual, motor, or mental impairments that hindered their ability to respond to the data collection instrument.

To determine the necessary sample size, an equation was employed. Equation 1 accounts for the significance level Zcrit, the variance of the variable p(1-p), and the total length of the confidence interval D.[11]

$$N = \frac{4(Z_{crit})^2 p(1-p)}{D^2} \quad (1)$$

Setting Zcrit at 1.96, corresponding to the 95% confidence quantile, p at 0.5 to maximize variance given the absence of a priori information, and varying the confidence interval length, the required sample size was determined to be n = 119. Data collection

occurred before patients underwent coronary angioplasty or outpatient cardiology consultations, upon acceptance and signature of the Informed Consent Form, resulting in a total of 136 patients.

Research data were stored in Microsoft Excel (MS-Office Windows 8). To describe the target population's technological profile, categorical data were presented as frequencies and percentages, while numerical data were presented as means and standard deviations.

The Shapiro-Wilk test was used to assess the normality of numerical data. When normality was confirmed, the t-test was used for intergroup comparisons; when normality was rejected, the Wilcoxon test was applied. For categorical variables, the chi-square test was employed to evaluate potential associations.

Health literacy was assessed using the eHEALS scale, which comprises eight items with scores ranging from 8 to 40. Mean scores and standard deviations were calculated for each item, with higher scores indicating greater digital health literacy.

The study was submitted to the Research Ethics Committee of the Federal University of Pernambuco and commenced upon approval on May 8, 2022, under favorable substantiated opinion number 5,394,540. The research was conducted in accordance with Resolution 466/12 of the Ministry of Health, which regulates research involving human subjects, adhering to the four bioethical principles: beneficence, non-maleficence, autonomy, and justice, ensuring the confidentiality of collected information and the privacy of participants' data.

Results

The study included 136 participants, slightly more than half of whom were female (70, 51.5%). The mean age of the sample was 62.9 years, with a standard deviation of 12.6. Most respondents, 70 (54.5%), were "married", and 59 (44.4%) identified as mixed-race. The largest portion of the sample, 48 (36.6%), had incomplete primary education.

Regarding the eHEALS scale questions, the mean score was 2.025, resulting in a total score of 16.2, indicating low digital health literacy. It was observed that most patients did not know how to find useful and reliable health information, assistance, or answers to their questions online. They reported lacking the ability to evaluate health

resources found online and did not feel confident in using such information to make health-related decisions.

Table 1- Digital health literacy, Recife-PE, Brazil, 2024

Item	Mean (Standard deviation)
Q1. I know how to find useful health information/resources on the internet	2.26 (1.41)
Q2. I know how to use the internet to answer my health questions	2.25 (1.37)
Q3. I know which health resources are available on the internet	2.05 (1.27)
Q4. I know where to find reliable health resources on the internet	1.98 (1.23)
Q5. I know how to use the health information I find online to help myself	2.02 (1.31)
Q6. I have the skills needed to evaluate health resources I find online	1.94 (1.27)
Q7. I can distinguish between low and high-quality health resources online	1.85 (1.20)
Q8. I feel confident using online information to make health decisions	1.85 (1.15)

Concerning the technological profile, smartphones/cell phones were the most common device used daily by the research participants, totaling 112 patients (82.4%), and they were also the preferred device for most patients, 120 (88.2%). Android (Google) was the most adopted mobile operating system among the interviewees. Only 10 (22.2%) did not know what an operating system was, and 15 (11.0%) reported not owning a smartphone/cell phone.

The primary method of internet access for most of the sample was via Wi-Fi, with 82 (60.3%). Approximately 61 (49.6%) connected daily, and 64 (47.1%) reported using their smartphones for less than 2 hours per day. More than 103 (75.7%) of the sample indicated that they accessed the internet via smartphone, and 83 (61.0%) rated their data connection speed as intermediate to fast. WhatsApp was the most frequently used social network, cited by 107 (47.6%) respondents, with audio and video as the media of greatest interest. The majority of the sample, 112 (82%), expressed interest in using an application related to their disease.

Table 2 – Technological profile of the sample, Recife-PE, Brazil, 2024

Characteristic	n=136 (%)
Which devices do you typically use in your daily life?	
Smartphone/cell phone	112 (82.4)
Computer/laptop	15 (11.0)
Tablet	7 (5.1)
None	20 (14.7)
Of the devices you own, which do you prefer to use most?	
Smartphone/cell phone	120 (88.2)
None	16 (11.8)
Do you know which operating systems your cell phone has?	
Android (Google)	89 (65.4)
iOS (Apple)	1 (0.7)
Do not know what an operating system is	31 (22.8)
Do not use	15 (11.0)
Do you have internet access?	
Yes	119 (87.5)
No	17 (12.5)
How do you access the internet?	
Via Wi-Fi	82 (60.3)
Via cell phone (3G/4G)	30 (22.1)
Do not typically or do not access the internet	24 (17.6)
How often do you access the internet?	
Rarely (almost never, a few hours)	26 (21.1)
Frequently (4 to 6 times a week or more)	17 (13.8)
Every day	61 (49.6)
Not informed	19 (15.5)
How much time per day do you spend on your cell phone?	
Less than 2 hours	64 (47.1)
Between 2 and 4 hours	21 (15.4)
More than 4 hours	32 (23.5)
Not informed	19 (14.0)
Do you access the internet via your cell phone?	
Yes	103 (75.7)
No	21 (15.5)
Not informed	12 (8.8)
How do you rate the speed of your data connection?	
I lose connection frequently	2 (1.5)
Slow	27 (19.9)
Intermediate/Fast	83 (61)
Not informed	24 (17.6)
Which applications do you use most?	
WhatsApp	107 (78.7)
Facebook	49 (36.0)
Instagram	45 (33.1)
I only make calls	24 (17.6)

Discussion

The digital health literacy in the population analyzed in the present study was low, with a mean score of 2.025 on the eHEALS scale and a total score of 16.2. Similar findings were observed by other authors when investigating the elderly population in family health units, which presented a mean total score of 18.7 on the same scale.[12]

The eHEALS scale is an instrument developed to measure the level of digital health literacy and is composed of eight items that evaluate the perceived knowledge, comfort, and skills of individuals regarding how to find, evaluate, and apply electronic health information to health problems. The higher the score, the greater the digital health literacy.[10]

The mean age of 62.9 years found in this study represents an elderly population, which indeed considers that this age group is part of digitally excluded citizens,[13] showing a digital gap when compared to younger generations. Furthermore, most patients had low education levels, which contributes to low health literacy,[3] a similar result found in a study where the North and Northeast regions prevailed as those with the lowest education levels among the elderly.[14]

Information and communication technologies represent a space in which older people can enjoy information related to various interests, maintain contact with family and friends, participate in social networks, access online services such as shopping and banking, and obtain information about health, leisure, education, work, and interaction/communication. Thus, digital inclusion among older people is understood to improve autonomy and quality of life.[15]

For the elderly to enjoy the benefits that technology offers, pedagogical strategies for digital inclusion must be used, considering digital literacy and the particularities and needs of these older people, such as intuitive interfaces.[15] It is essential to invest in training and digital inclusion programs, and technologies need to adapt to the elderly public,[16] not only to improve opportunities for these people but also to leverage the knowledge of this population through intergenerational exchange.[17]

In Brazil, the percentage of elderly people with internet access increased from 12.6% in 2013 to 62.1% in 2022,[18] a higher percentage than found in this study, totaling

119 (87.5%) of the elderly with internet access. Regarding the time spent on the internet via smartphones, 64 (54.7%) of the research participants reported spending less than two hours. Similar results were evidenced in a comprehensive cross-sectional study, with 51% (48) of the elderly spending the same amount of time.[14]

The internet is an important tool for disseminating knowledge, with a positive effect on health literacy and improving individuals' behavior and self-care. However, if technology is not easily accessible and understandable, it can become ineffective, especially for older individuals who cannot efficiently access or interpret health information. Health education interventions need to be adapted to the individual's literacy level to effectively promote health and prevent disease.[8,19]

In the present study, it was found that most research participants prefer to use smartphones (82.4%), a similar finding to research where the most used equipment to access the internet in 2022 was the mobile phone (98.9%).[18] Smartphones have gained the interest of the elderly population by incorporating computer functionality into mobile phones, such as internet connection and the possibility of using applications.[20]

Despite the increased use of smartphones in daily life, the study showed that 15 (11%) participants did not own the device, a similar finding to that found by other authors, with 12% of the researched sample.[20] Difficulties can occur due to unfamiliarity, apprehension, and fear of manipulating certain devices, as well as physical and mental declines related to aging. Regarding the challenges faced by the elderly population, the most reported reason for not accessing the internet was "because they don't know how to use it" (47.7%), hence the importance of educational interventions and adapting technology to the target audience.[18]

Mobile applications have become important healthcare assistance tools, as they allow for remote patient support, health self-care, aid public policies in disease promotion and control, and encourage users to maintain or initiate beneficial health practices.[21]

In the treatment of coronary patients, several studies have shown an improvement in medication adherence and lifestyle changes with the use of mobile applications.[22-23] Furthermore, combinations of follow-up strategies, such as medication reminders, narrative-based patient education, and educational materials sent via

messaging applications, have shown positive results regarding glycated hemoglobin, with an average reduction of 1.5 mg/dl, and high-density lipoprotein cholesterol, with an average increase of 0.61 mg/dl, in addition to the fact that 84% of patients achieved or exceeded their prescribed physical activity goals.[23-24]

In a systematic review, the results were positive, affirming that the use of applications that encourage behavioral change, physical exercise, and health education had a positive impact on the adoption of healthy lifestyle habits, regarding eating behavior, weight reduction, and physical activity.[25] The authors also state that education via applications, using clear and objective communication,[26] associated with complementary strategies, were the most used and showed potential regarding behavioral changes.

A scope review conducted to identify health literacy interventions in the secondary prevention of coronary artery disease identified that deficits in health literacy are common in these patients and that online educational interventions, such as family involvement for education, home exercise planning, and educational support via smartphones, showed positive results with reports of improvements in literacy and patient health behaviors.[27] Therefore, online interventions can be used as strategies to address the barriers of low health literacy and improve the health behavior of patients with coronary disease.

In nursing practice, mobile applications and telehealth have changed the way nurses perform their interventions and communicate with patients and other healthcare professionals. This allows for preventive, diagnostic, and treatment actions for diseases, being used as educational strategies in health.[4,28] The assessment of digital literacy is essential to plan effective educational interventions.

Mobile applications are tools that allow nurses to expand their knowledge, improve work organization, and strengthen ties with patients and families. They are allies in controlling disease symptoms, medication adherence, and nurse-patient communication. As a contribution, the study provides knowledge of the digital literacy and technological profile of the coronary population, which can be used as a basis for educational interventions and self-care guidance, to improve engagement in treatment and quality of life for patients with coronary artery disease.[4,29]

As a limitation, the present study reflects the context of the cardiology outpatient clinic of a university hospital, thus reflecting the reality of that population.

Conclusion

The present study demonstrated that the digital health literacy of coronary patients followed up at the cardiology outpatient clinic of a university hospital is low, necessitating educational interventions that consider the elderly population and the digital gap they face. Despite this, most patients reported that they would like to use a mobile application that is specific to their health and assists in the self-management of their disease, highlighting the idea that, despite generational differences, elderly individuals with coronary artery disease seek autonomy in a digital age.

Regarding the technological profile, it was observed that coronary patients have internet access, consider the connection speed to be intermediate to fast, prefer the use of smartphones, access the internet from their mobile devices, and spend an average of two hours per day connected. Therefore, mobile applications emerge as an educational strategy, considering the teaching-learning process of this age group and digital health literacy, allowing for digital inclusion and the overcoming of the digital gap they belong to, promoting health education, the adoption of healthy habits, and improved quality of life for coronary patients.

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