PEDAGOGICAL ACADEMY:
SCIENTIFIC NOTES

INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION

UDC 004.5:616.89-008.48:614.2

DOI https://doi.org/10.5281/zenodo.20629609

Accessibility barriers in mobile medical applications for users with cognitive impairments: analysis, impact assessment, and design recommendations

Vitalii Khomenko,

Principal Designer, Orizon Design, 9421-5852 Quebec inc.,

Canada,

https://orcid.org/0009-0008-2838-0013

Accepted: 12.05.2026 | Published: 30.05.2026

Abstract. Relevance. *The rapid digitalization of healthcare has led to the widespread adoption of mobile medical applications for health monitoring, medication management, telemedicine services, and continuous patient–provider communication. At the same time, a significant proportion of users of these applications are individuals with cognitive impairments, including age-related cognitive decline, ADHD, post-stroke deficits, dementia, and other neurocognitive conditions. Insufficient adaptation of mobile healthcare applications to the cognitive needs of these users creates substantial barriers to effective interaction, increasing the risk of errors and negatively affecting treatment adherence, patient safety, and healthcare outcomes.* ***Purpose.*** *The study aims to identify the primary cognitive accessibility barriers present in mobile medical applications, assess their impact on the safety and effectiveness of digital healthcare services, and develop practical recommendations for improving interface design for users with cognitive impairments.* ***Methods.*** *The research is based on a review of peer-reviewed scientific publications published between 2020 and 2025, combined with a heuristic evaluation of three widely used healthcare applications –*

MyChart, Medisafe, and Ada – against the cognitive accessibility criteria of WCAG 2.1. The study employs methods of literature synthesis, comparative analysis, and expert assessment of interface design solutions. ***Results.*** *Six major categories of cognitive accessibility barriers were identified: excessive navigation depth, information overload, unpredictable interface behavior, inadequate error prevention and recovery mechanisms, absence of multimodal communication, and insufficient personalization. The findings demonstrate that these barriers directly affect users' decision-making processes, complicate the completion of critical healthcare tasks, reduce treatment adherence, and may lead to clinically significant consequences. The findings further indicate that simplified navigation paths, stable interaction patterns, user-friendly error recovery mechanisms, multimodal information presentation, and adaptive interface solutions may significantly improve accessibility and usability for users with cognitive impairments.* ***Conclusions.*** *Cognitive accessibility is a fundamental prerequisite for ensuring equitable access to digital healthcare services and enhancing patient safety. Addressing the identified barriers requires the systematic integration of cognitive accessibility principles throughout the design and development process, the adoption of inclusive design practices, and the active involvement of individuals with cognitive impairments in usability testing and interface evaluation. Such measures can improve treatment adherence, reduce interaction-related errors, and support safer engagement with digital healthcare services.*

Keywords: *cognitive accessibility, mobile health, UX/UI in medicine, inclusive design, cognitive load, navigation usability, digital healthcare, adaptive interfaces, patient safety, WCAG 2.1.*

PEDAGOGICAL ACADEMY:
SCIENTIFIC NOTES

Бар'єри доступності в мобільних медичних застосунках для користувачів із когнітивними порушеннями: аналіз, оцінювання впливу та рекомендації щодо проектування

Хоменко Віталій Юрійович,
головний дизайнер, Orizon Design, 9421-5852 Quebec inc.,
Канада,
https://orcid.org/0009-0008-2838-0013

Анотація: Актуальність. *Стрімка цифровізація системи охорони здоров'я сприяє активному впровадженню мобільних медичних застосунків для моніторингу стану здоров'я, контролю прийому лікарських засобів, організації телемедичних консультацій та підтримки безперервної взаємодії між пацієнтами й медичними працівниками. Водночас значна частина користувачів таких систем належить до категорії осіб із когнітивними порушеннями, включаючи вікове зниження когнітивних функцій, синдром дефіциту уваги та гіперактивності, наслідки інсульту, деменцію та інші нейрокогнітивні стани. Недостатня адаптація мобільних медичних застосунків до особливостей сприйняття, пам'яті та уваги цих користувачів створює ризики помилок під час взаємодії з інтерфейсом, що може негативно впливати на безпеку пацієнтів, прихильність до лікування та якість медичної допомоги.*

Мета *дослідження полягає у виявленні основних бар'єрів когнітивної доступності в мобільних медичних застосунках, оцінюванні їхнього впливу на безпеку та ефективність використання цифрових медичних сервісів, а також у розробленні практичних рекомендацій щодо вдосконалення проєктування інтерфейсів для користувачів із когнітивними порушеннями.*

Методи. *Дослідження ґрунтується на аналізі сучасних наукових публікацій, опублікованих у 2020–2025 роках, а також на евристичному*

оцінюванні мобільних медичних застосунків MyChart, Medisafe та Ada відповідно до критеріїв когнітивної доступності WCAG 2.1. У роботі використано методи систематизації наукових джерел, порівняльного аналізу та експертної оцінки інтерфейсних рішень.

Результати. *У ході дослідження визначено шість ключових категорій бар'єрів когнітивної доступності: надмірну глибину навігації, інформаційне перевантаження інтерфейсу, непередбачувану поведінку елементів взаємодії, недостатні механізми запобігання та виправлення помилок, відсутність мультимодальної комунікації та недостатній рівень персоналізації. Встановлено, що зазначені бар'єри безпосередньо впливають на процес прийняття рішень користувачами, ускладнюють виконання критично важливих медичних завдань, знижують рівень прихильності до лікування та можуть спричиняти клінічно значущі наслідки. Обґрунтовано доцільність впровадження спрощених сценаріїв навігації, стабільних навігаційних структур, зрозумілих механізмів обробки помилок, мультимодального подання інформації та адаптивних інтерфейсних рішень.*

Висновки. *Когнітивна доступність мобільних медичних застосунків є важливою передумовою забезпечення рівного доступу до цифрових медичних послуг та підвищення безпеки пацієнтів. Усунення виявлених бар'єрів потребує системного врахування когнітивних особливостей користувачів на всіх етапах проєктування інтерфейсу, застосування принципів інклюзивного дизайну та залучення осіб із когнітивними порушеннями до процесів тестування і вдосконалення цифрових медичних продуктів.*

Ключові слова: *когнітивна доступність, мобільне здоров'я, UX/UI-дизайн у медицині, інклюзивний дизайн, когнітивне навантаження, зручність навігації, цифрова охорона здоров'я, адаптивні інтерфейси, безпека пацієнтів, WCAG 2.1.*

Problem statement. Mobile health applications have become an essential mechanism for delivering modern healthcare services, enabling appointment management, medication reminders, symptom monitoring, telehealth consultations, and access to laboratory results through smartphone interfaces. While this digital transformation has improved healthcare accessibility and continuity for many users, it has often produced the opposite effect for individuals with cognitive impairments. According to the World Health Organization, more than 55 million people worldwide live with dementia, with approximately 10 million new cases diagnosed annually. When age-related cognitive decline, attention deficit hyperactivity disorder (ADHD), post-stroke deficits, intellectual disabilities, and neurodevelopmental conditions are also considered, the population of cognitively vulnerable healthcare technology users becomes both substantial and continuously growing.

The relationship between interface inaccessibility and clinical harm is direct. A patient with memory impairment who cannot effectively navigate a medication management application may miss prescribed doses. A user with attention deficits who misinterprets an overloaded notification screen may take medication incorrectly. A post-stroke patient who encounters a redesigned interface and loses familiar navigation pathways may disengage from digital healthcare services altogether. Likewise, an older adult who cannot complete a telehealth check-in because of complex multi-step authentication procedures may forgo necessary medical consultations.

These issues cannot be regarded as isolated cases. Research consistently demonstrates that interface complexity reduces treatment adherence and patient engagement among cognitively vulnerable populations. The problem is further intensified by the prevailing design approach in many healthcare applications, which prioritizes functional completeness and the continuous addition of features rather than cognitive ergonomics and the reduction of interaction complexity. Under such conditions, cognitive accessibility should be considered not as an optional

enhancement but as a clinical requirement that directly affects patient safety, treatment effectiveness, and equitable access to digital healthcare services.

Analysis of recent research and publications. The issues of digital healthcare accessibility and the adaptation of mobile technologies to the needs of users with cognitive impairments have attracted increasing scholarly attention in recent years. I. Orlenko [1] investigates the problems of digital inclusion for individuals with cognitive impairments and identifies barriers that limit their effective participation in digital environments. L. Bashkirova and co-authors [2] analyze the educational and practical potential of mobile medical applications and their role in improving access to healthcare information. Technical aspects of healthcare information systems and approaches to enhancing their functionality are examined by V. Levkivskyi [3].

Issues related to the adaptation of mobile applications for users with cognitive impairments are considered by D. Fedasyuk and I. Lutsyk [4]. Human-centered requirements for mHealth applications intended for people with cognitive impairments, their caregivers, and healthcare professionals are investigated by I. Lazarou and co-authors [5]. The effectiveness of mobile health interventions for older adults with mild cognitive impairment and dementia is assessed by N. J. T. Wee and co-authors [6], while M. Lee and co-authors [7] evaluate the impact of mobile healthcare applications on this user population through a systematic review and meta-analysis.

The quality and functionality of cognitive training applications are analyzed by L. Wu and co-authors [8], who emphasize the importance of adaptive digital solutions for cognitive support. P. Giannopoulou and P. Vlamos [9] investigate the design and development of mobile information systems for cognitive training. Practical aspects of supporting individuals with dementia and communication impairments through mobile applications are examined by S. Cheraghi-Sohi and co-authors [10], who highlight the importance of user-centered design approaches.

The potential of artificial intelligence for enhancing healthcare applications is explored by A. Bohr and K. Memarzadeh [11]. In turn, E. Irazoki and co-authors [12]

analyze technologies for cognitive training and rehabilitation for individuals with mild cognitive impairment and dementia, demonstrating the growing significance of digital solutions in supporting cognitive functioning and healthcare engagement.

Despite the growing body of research devoted to mobile health technologies, cognitive training systems, and digital support tools for individuals with cognitive impairments, the issue of cognitive accessibility in mobile medical applications remains insufficiently investigated. Existing studies predominantly focus on technological capabilities, intervention effectiveness, and general usability considerations, whereas the relationship between specific interface barriers, cognitive limitations, and healthcare outcomes has received considerably less attention. This highlights the need for further research into cognitive accessibility barriers and the development of evidence-based design solutions for mobile healthcare applications.

Identification of previously unresolved parts of the general problem. Despite the existence of accessibility standards and guidelines, cognitive accessibility in mobile medical applications remains insufficiently addressed in practice. WCAG 2.1 includes several criteria related to cognitive accessibility; however, compliance with these requirements does not necessarily ensure effective and independent use of healthcare applications by individuals with cognitive impairments. Consequently, a significant gap persists between technical accessibility compliance and real-world usability. This highlights the need to identify specific interface barriers that hinder interaction and to develop design approaches capable of improving cognitive accessibility within mobile healthcare environments.

Formulation of the objectives of the article (task setting). The purpose of the article is to identify and analyze the primary accessibility barriers in mobile medical applications for users with cognitive impairments, assess their impact on healthcare interaction and patient safety, and develop practical design recommendations for improving cognitive accessibility in digital healthcare environments.

Objectives of the article:

1. To define the concept of cognitive accessibility and examine the relationship between interface design and the usability of mobile medical applications for users with cognitive impairments.

2. To identify and characterize the major accessibility barriers in mobile healthcare applications, determine the cognitive functions affected by these barriers, and assess their potential clinical consequences.

3. To develop practical design recommendations aimed at reducing cognitive barriers, improving healthcare interaction, and enhancing the accessibility of mobile medical applications for cognitively impaired users.

Main material. Based on the analysis of contemporary scientific literature and the heuristic evaluation of the mobile healthcare applications MyChart, Medisafe, and Ada, six primary categories of accessibility barriers affecting users with cognitive impairments were identified. These barriers influence the effectiveness of interaction with healthcare services, reduce treatment adherence, and may negatively affect patient safety.

One of the most significant barriers is excessive navigation depth. In many mobile healthcare applications, users are required to navigate through multiple interface layers to complete routine tasks. For example, in MyChart, requesting a medication refill may involve several consecutive navigation steps, including access to the main menu, health summary, medication list, medication details, and refill request form. Such interaction structures create additional cognitive demands on working memory and sequential information processing. Since working memory is particularly vulnerable to age-related cognitive decline, dementia, and post-stroke impairments, complex navigation hierarchies frequently lead to disorientation, task abandonment, and interaction errors. Fedasyuk and Lutsyk [5] demonstrated that users with cognitive impairments exhibit significantly higher rates of task abandonment when navigation structures exceed two hierarchical levels. As a result, excessive navigation complexity

contributes to reduced medication adherence, missed appointments, and decreased engagement with digital healthcare services.

Another major barrier is information overload. Many healthcare applications present large volumes of heterogeneous information within a single interface screen without providing a clear visual hierarchy. For example, patient dashboards may simultaneously display appointment schedules, laboratory results, unread messages, medication lists, and health reminders. Such information density increases cognitive demands on attention and selective information processing. Individuals with attention deficits, dementia, or post-stroke cognitive impairments often experience difficulties distinguishing priority information from secondary content. According to Wee et al. [7], cognitive fatigue caused by information-dense interfaces represents one of the primary reasons for disengagement from mobile health technologies among older adults with mild cognitive impairment. Consequently, information overload may lead to misinterpretation of important notifications, difficulties in completing priority tasks, and progressive disengagement from healthcare applications.

Unpredictable interface behavior constitutes a further accessibility challenge. Interface elements may change position following software updates, content structures may be dynamically reorganized, and interaction scenarios may vary depending on contextual conditions. In conversational systems such as Ada, interface states are generated dynamically, while MyChart has repeatedly modified dashboard layouts through software updates. Such changes disrupt established interaction habits and reduce the benefits of procedural memory, which is often relatively preserved in individuals with early-stage dementia. When familiar navigation patterns disappear, users are forced to relearn interaction processes using cognitive functions that may already be impaired [4]. As a result, abrupt interface modifications frequently cause users to discontinue application use, particularly when external support is unavailable.

A fourth barrier concerns inadequate error prevention and recovery mechanisms. Many applications provide insufficient warnings before irreversible actions, employ

technical terminology in error messages, and require users to navigate through multiple screens to correct mistakes. Examples include accidental appointment cancellations without confirmation dialogs or technical notifications such as “Authorization token expired” that provide no meaningful guidance to users. Since executive functioning is frequently impaired in individuals with cognitive disorders, difficulties in understanding and correcting interaction errors become particularly problematic. Lazarou et al. [6] identified error recovery complexity as one of the most frequently reported sources of frustration among cognitively impaired users and their caregivers. Such limitations may result in incorrect symptom reporting, accidental cancellation of appointments or prescriptions, and long-term loss of trust in digital healthcare services.

The absence of multimodal communication also represents an important accessibility barrier. Many healthcare applications rely almost exclusively on written text, with limited use of icons, audio support, or visual reinforcement mechanisms. Medication names are frequently displayed using pharmaceutical terminology, while instructions are presented in lengthy textual formats. None of the reviewed applications provided text-to-speech support for medication instructions. These limitations create difficulties for users with aphasia, dyslexia, mild dementia, or low health literacy. Cheraghi-Sohi et al. [10] found that users with mild dementia demonstrated significantly higher task completion rates when textual instructions were supplemented with icons and audio cues. Consequently, insufficient multimodal communication may lead to incorrect interpretation of dosage instructions, missed healthcare procedures, and reduced participation in self-monitoring activities.

The final barrier involves insufficient personalization and adaptive support. Most healthcare applications provide identical interfaces regardless of users’ cognitive characteristics, usage history, or demonstrated interaction difficulties. Simplified interface modes, caregiver-assisted views, advanced font customization, and context-sensitive guidance mechanisms are often absent. However, cognitive impairments are highly heterogeneous, and the needs of users with ADHD differ substantially from

those of individuals with Alzheimer's disease or post-stroke cognitive deficits. Wu et al. [9] reported that only 20.8% of cognitive health applications included any form of personalized interaction support despite personalization being consistently identified as a priority requirement by both users and caregivers. The absence of adaptive functionality reduces application usability over time, particularly as cognitive impairments progress and continuous engagement with digital healthcare services becomes increasingly important.

Table 1

Primary accessibility barriers, affected cognitive functions, and clinical impact

Accessibility barrier	Affected cognitive function	Example in mobile healthcare applications	Clinical risk level	Impact on healthcare interaction
Excessive navigation depth	Working memory, sequential processing	Mychart: multi-step medication refill process	High	Missed doses, task abandonment
Information overload	Selective attention, information filtering	Mychart: information-dense patient dashboard	High	Misinterpretation of notifications, disengagement
Unpredictable interface behavior	Procedural memory, adaptation	Ada: dynamic interaction states; mychart: interface redesigns	Medium–high	Post-update disengagement, relearning difficulties
Inadequate error prevention and recovery	Executive functioning, self-correction	Technical error messages, absence of confirmation dialogs	High	Incorrect actions, loss of trust
Absence of multimodal communication	Language processing, reading comprehension	Text-only medication instructions	Medium–high	Dosage misinterpretation, procedural errors
Insufficient personalization	Adaptation to impairment-specific needs	Uniform interface regardless of cognitive profile	Medium	Reduced usability as cognitive impairment progresses

Source: developed by the author based on [1; 4; 5; 6; 10].

The findings summarized in Table 1 demonstrate that each accessibility barrier is associated with a specific cognitive mechanism and produces distinct consequences

for healthcare interaction. While the barriers differ in their manifestations, all of them increase cognitive effort, reduce task completion success, and negatively affect engagement with digital healthcare services. Particularly concerning are barriers associated with navigation complexity, information overload, and inadequate error recovery, as these have direct implications for treatment adherence and patient safety. The results further indicate that cognitive accessibility should be considered a clinical requirement rather than a purely technical usability concern.

The analysis of the identified accessibility barriers demonstrates that improving cognitive accessibility in mobile medical applications requires targeted design interventions directly aligned with the limitations observed during healthcare interaction. Each recommendation proposed below corresponds to a specific barrier category and is grounded in relevant WCAG 2.1 accessibility requirements.

To address excessive navigation depth, critical healthcare tasks should be accessible through a maximum of two interaction steps. The most frequently used patient functions, including medication confirmation, appointment management, messaging, emergency contact access, and test result review, should be reachable directly from the home screen. Persistent navigation structures containing a limited number of primary options should be maintained throughout the application, while additional functionality should be revealed progressively only after the completion of core tasks. Such measures reduce demands on working memory and support more efficient task completion.

The problem of information overload may be mitigated through the establishment of a clear visual hierarchy. Each screen should emphasize a single primary action or information element, while secondary content should be grouped into expandable sections that remain hidden until required. Dashboard layouts should present only the information necessary for immediate decision-making and avoid excessive content density. These modifications facilitate selective attention and reduce cognitive fatigue associated with information-rich interfaces.

To minimize the negative effects of unpredictable interface behavior, navigation structures should remain stable across software updates and user sessions. Core navigation elements, labels, and interaction patterns should not be modified unless absolutely necessary. When significant interface changes cannot be avoided, users should receive explicit guidance explaining the new layout and functionality. For conversational and AI-supported healthcare applications, persistent contextual summaries should be provided to assist users in maintaining orientation throughout the interaction process.

Improving error prevention and recovery requires the implementation of clear confirmation mechanisms before irreversible actions are performed. Appointment cancellations, prescription requests, and account modifications should always be accompanied by confirmation dialogs that explicitly describe the consequences of the action. Error messages should be rewritten using plain language and provide straightforward instructions for corrective action. In addition, reversible actions should support simple recovery mechanisms that allow users to undo unintended operations within the same interaction session.

The absence of multimodal communication can be addressed through the integration of complementary information formats. Critical healthcare information, including medication instructions, appointment details, and diagnostic results, should be available through text-to-speech functionality in addition to written text. Medication information should combine pharmaceutical names with visual representations and plain-language explanations of therapeutic purpose. Navigation and action elements should employ icon-and-label combinations to facilitate comprehension and reduce dependence on text-only interaction.

To support users with diverse cognitive profiles, healthcare applications should incorporate personalization and adaptive assistance mechanisms. Simplified interface modes should provide access only to essential functions while increasing font sizes and touch target dimensions. Caregiver-linked views may assist users who require external

support for administrative or health-management tasks. Furthermore, applications should monitor repeated task failures and proactively offer contextual assistance when interaction difficulties are detected. Such adaptive approaches acknowledge the heterogeneous nature of cognitive impairments and help maintain long-term engagement with digital healthcare services.

Table 2

Design recommendations, addressed barriers, implementation effort, and expected impact

Recommendation	Barrier Addressed	Implementation Effort	Expected Impact
Two-step maximum task paths	Navigation depth	Medium	High – directly reduces task abandonment
Single-action screen hierarchy	Information overload	Medium	High – reduces attention fragmentation
Navigation stability policy	Unpredictable behavior	Low	High – preserves procedural memory
Error prevention and plain-language recovery	Error recovery	Low–Medium	High – reduces critical interaction errors
Text-to-speech and icon-label combinations	Multimodal communication	Medium–High	High for users with aphasia, dementia, and low health literacy
Simplified mode and caregiver-linked view	Personalization	High	High – supports continued use as cognitive conditions progress

Source: author's synthesis based on [5, 6, 7, 9, 10].

The recommendations presented in Table 2 demonstrate that the majority of proposed improvements require moderate implementation effort while offering substantial usability benefits. The greatest expected impact is associated with

interventions aimed at reducing navigation complexity, preventing interaction errors, supporting multimodal communication, and introducing adaptive assistance mechanisms. Collectively, these measures contribute to safer healthcare interaction, improved treatment adherence, and greater accessibility of digital health services for individuals with cognitive impairments.

Despite the availability of practical design recommendations, their implementation in contemporary mobile healthcare applications remains limited. One of the principal challenges is the absence of a standardized framework for evaluating cognitive accessibility. Existing automated accessibility assessment tools are capable of measuring technical parameters such as color contrast, keyboard navigation, and alternative text availability; however, they cannot adequately evaluate whether interface structures exceed working memory capacity, create excessive cognitive load, or present barriers for users with language-processing difficulties. As a result, applications may formally satisfy accessibility requirements while remaining difficult to use for individuals with cognitive impairments [1].

Another significant challenge concerns the evaluation process itself. Effective assessment of cognitive accessibility requires the participation of users with cognitive impairments, yet such studies are considerably more complex to organize than conventional usability testing. Additional ethical considerations, caregiver involvement, specialized facilitation, and extended testing procedures increase the resources required for meaningful evaluation. Consequently, many healthcare applications are tested primarily with cognitively healthy users, limiting the validity of accessibility findings for the populations that may benefit most from adaptive interface solutions [9].

The implementation of cognitive accessibility measures is further complicated by prevailing product development priorities. Healthcare applications operate within environments characterized by regulatory requirements, extensive functional demands, and competitive pressure to continuously expand feature sets. Under such conditions,

interface simplification is frequently perceived as a reduction of functionality rather than an improvement in usability. This often results in increasing interface complexity despite the documented needs of users with cognitive impairments.

Finally, cognitive accessibility remains an interdisciplinary challenge that requires collaboration among specialists in cognitive psychology, clinical neuropsychology, healthcare, interaction design, and software engineering. The knowledge necessary to design cognitively accessible healthcare applications is distributed across multiple disciplines that often operate independently from one another. Therefore, effective implementation of cognitive accessibility principles requires systematic interdisciplinary cooperation throughout the design and development process rather than post-implementation accessibility reviews [12].

Conclusions. The study identified six major accessibility barriers that affect the usability of mobile medical applications for individuals with cognitive impairments: excessive navigation depth, information overload, unpredictable interface behavior, inadequate error prevention and recovery, absence of multimodal communication, and insufficient personalization. The analysis demonstrated that each barrier is associated with specific cognitive limitations and may negatively influence treatment adherence, patient safety, and continuity of digital healthcare engagement.

The findings indicate that these barriers are not isolated design flaws but rather the consequence of development approaches that prioritize functional expansion over cognitive ergonomics, provide limited opportunities for testing with cognitively impaired users, and lack standardized mechanisms for evaluating cognitive accessibility. Consequently, formally accessible applications may remain difficult to use in real healthcare contexts.

The practical significance of the study lies in the development of targeted design recommendations aimed at reducing cognitive load, improving navigation predictability, strengthening error prevention mechanisms, supporting multimodal communication, and enhancing interface adaptability. The proposed measures may

contribute to safer and more effective interaction with digital healthcare services for users with diverse cognitive needs.

At the same time, the study highlights the need for further empirical research focused on direct observation of cognitively impaired users performing real healthcare tasks in mobile applications. Such investigations would provide a stronger evidence base for validating accessibility barriers, assessing their relative impact, and refining adaptive design solutions for future mobile healthcare systems.

Limitations of the study should also be acknowledged. The analysis was based on literature synthesis and heuristic evaluation of three healthcare applications in their publicly available interface states. No direct observations involving users with cognitive impairments were conducted, and the analyzed applications may have changed since the time of evaluation. Furthermore, the proposed six-barrier framework is analytically derived and may be expanded or refined through future empirical research.

References

1. Orlenko I. Digital Inclusion: Diagnosing the Problems of Users with Cognitive Impairments. *Інклюзія і суспільство*. 2025. № 1. С. 46–54. DOI: https://doi.org/10.32782/2787-5137-2025-1-6.

2. Bashkirova L., Borysiuk I., Riabokon S. Mobile Applications in Medical Education of Ukraine: Potential for Self-Education, Practical Training, and Access to Medical Information. *Медицина та фармація: освітні дискурси*. 2024. № 3. С. 3–8. DOI: https://doi.org/10.32782/eddiscourses/2024-3-1.

3. Levkivskyi V. Models and Methods for Improving the Construction of Medical Information Systems. *Вісник Хмельницького національного університету. Серія: Технічні науки*. 2023. Vol. 327. Вип. 5. № 2. С. 54–59. DOI: https://doi.org/10.31891/2307-5732-2023-327-5-54-59.

4. Fedasyuk D., Lutsyk I. Tools for Adaptation of a Mobile Application to the Needs of Users with Cognitive Impairments. *2021 IEEE 16th International Conference on Computer Sciences and Information Technologies (CSIT)*. 2021. Vol. 1. P. 321–324. DOI: https://doi.org/10.1109/CSIT52700.2021.9648702.

5. Lazarou I., Stavropoulos T. G., Mpaltadoros L., Nikolopoulos S., Koumanakos G., Tsolaki M., Kompatsiaris I. Human Factors and Requirements of People with Cognitive Impairment, Their Caregivers, and Healthcare Professionals for mHealth Apps Including Reminders, Games, and Geolocation Tracking: A Survey-Questionnaire Study. *Journal of Alzheimer's Disease Reports*. 2021. Vol. 5. № 1. P. 497–513. DOI: https://doi.org/10.3233/ADR-201001.

6. Wee N. J. T., Lun P., Guo L., Shi L., Chan E. S. Y., Low Y. H. J. A Systematic Review and Meta-Analysis of Mobile Health Application Interventions for Community-Dwelling Older Adults with Mild Cognitive Impairment and Dementia. *Alzheimer's & Dementia*. 2024. Vol. 20. Article e085504. DOI: https://doi.org/10.1002/alz.085504.

7. Lee M., Park J., Lee S. Effects of Mobile Health Applications in Older Adults with Dementia or Mild Cognitive Impairment: A Systematic Review and Meta-Analysis. *Korean Journal of Adult Nursing*. 2024. Vol. 36. № 2. P. 112–125. DOI: https://doi.org/10.7475/kjan.2024.36.2.112.

8. Wu L., Pan J., Dou C., Gu A., Huang A., Tao H., Wang L. Cognitive Training Mobile Apps for Older Adults with Cognitive Impairment: App Store Search and Quality Evaluation. *JMIR mHealth and uHealth*. 2025. Vol. 13. Article e69637. DOI: https://doi.org/10.2196/69637.

9. Giannopoulou P., Vlamos P. Analysis and Design of an Information System for Cognitive Training of Patients with Mild Cognitive Impairment Using Mobile Devices. *2020 5th South-East Europe Design Automation, Computer Engineering, Computer Networks and Social Media Conference (SEEDA-CECNSM)*. 2020. P. 1–6. DOI: https://doi.org/10.1109/SEEDA-CECNSM49515.2020.9221782.

10. Cheraghi-Sohi S., Davies K., Gordon L., Jones H., Sanders C., Ong B. N. A Study to Explore the Usefulness of a Mobile Health Application to Support People with Mild Cognitive and/or Communication Impairment Due to Dementia and Their Carers. *Digital Health*. 2023. Vol. 9. Article 20552076231173560. DOI: https://doi.org/10.1177/20552076231173560.

11. Bohr A., Memarzadeh K. The Rise of Artificial Intelligence in Healthcare Applications. *Artificial Intelligence in Healthcare*. 2020. P. 25–60. DOI: https://doi.org/10.1016/B978-0-12-818438-7.00002-2.

12. Irazoki E., Contreras-Somoza L. M., Toribio-Guzmán J. M., Jenaro-Río C., Van der Roest H., Franco-Martín M. A. Technologies for Cognitive Training and Cognitive Rehabilitation for People with Mild Cognitive Impairment and Dementia: A Systematic Review. *Frontiers in Psychology*. 2020. Vol. 11. Article 648. DOI: https://doi.org/10.3389/fpsyg.2020.00648.