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ORIGINAL ARTICLE

GERONTO-APS-FARMA: mobile information app on the most appropriate medications for older adults

GERONTO-APS-FARMA: aplicación móvil informativa sobre los medicamentos más indicados en el adulto mayor

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ABSTRACT

Background: Population aging in Cuba is a health problem established as a priority program by the Ministry of Public Health. In the primary care setting, there are few digital tools that provide information on the most appropriate medications for older adults.

Objective: to design a mobile application containing basic information on the most appropriate medications for older adults in primary health care.

Methods: applied research in the field of technological innovation was carried out between January 2024 and December 2025 at the Villa Clara University of Medical Sciences. Theoretical methods were used: analytical-synthetic, inductive-deductive, historical-logical, and modeling; empirical methods: bibliographic review and group work. Its content was validated through specialist criteria and its functionality by users. The application is designed using the new HTML5 web standard.

Results: an application with easy-to-use interfaces was designed to encourage its use and capture users' attention. It offers a rapid information alternative on the most appropriate medications for older adults in primary care. Its structure is organized by pharmacological groups: cardiovascular system, antimicrobials, non-steroidal anti-inflammatory drugs, digestive system, central nervous system, endocrine system, and ophthalmology, dermatology, respiratory system, and natural and traditional medicine medications, to facilitate information access.

Conclusions: GERONTO-APS-FARMA is a mobile phone application aimed at providing information on the most appropriate medications for older adults. The application allows users to obtain pharmacological information in an accessible, rapid, and up-to-date manner. It was evaluated satisfactorily by specialist criteria and users.

MeSH: demographic aging; geriatrics; information technology; national health programs; health programs and plans; education, medical

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RESUMEN

Fundamento: el envejecimiento poblacional en Cuba es un problema de salud instituido como programa prioritario por el Ministerio de Salud Pública. En el primer nivel de atención

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se evidencian pocas herramientas digitales que ofrezcan información sobre los medicamentos más indicados en los adultos mayores.

Objetivo: diseñar una aplicación móvil que contenga información básica sobre los medicamentos más indicados en los adultos mayores en el primer nivel de atención de salud.

Métodos: se realizó una investigación aplicada en el campo de la innovación tecnológica entre los meses enero 2024-diciembre 2025 en la Universidad de Ciencias Médicas de Villa Clara. Se utilizaron métodos teóricos: analítico–sintético, inductivo-deductivo, histórico-lógico y la modelación; empíricos: revisión bibliográfica, trabajo grupal. Su contenido fue validado mediante el criterio de especialistas y su funcionalidad por usuarios. La aplicación está diseñada en el nuevo estándar web HTML5.

Resultados: se diseñó una aplicación con interfaces de fácil manipulación para incentivar su uso y atrapar la atención de los usuarios. Ofrece una alternativa de información rápida sobre los medicamentos más indicados en los adultos mayores en el primer nivel de atención, su estructura está organizada por grupos farmacológicos: aparato cardiovascular, antimicrobianos, antiinflamatorios no asteroideos, aparato digestivo, sistema nervioso central, sistema endocrino y oftalmología, dermatología, aparato respiratorio y medicamentos de la medicina natural y tradicional, para facilitar la información.

Conclusiones: GERONTO-APS-FARMA es una aplicación para teléfonos móviles, dirigida a ofrecer información sobre los medicamentos más indicados en los adultos mayores. La aplicación le permite al usuario obtener información farmacológica de forma accesible, rápida y actualizada. Fue valorada satisfactoriamente por criterios de especialistas y usuarios.

DeCS: envejecimiento de la población; Geriatría; tecnología de la información; programas nacionales de salud; planes y programas de salud; educación médica

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INTRODUCTION

The informatization policy established in Cuba has enabled a visible acceleration in access to information and communication technologies (ICTs) in recent years. The development of mobile applications for smartphones designed to perform specific actions or tasks has revolutionized the social, educational, and health fields, among others.[1]

The creation of mobile applications has grown exponentially in recent years, proving to be an accessible and powerful tool in the teaching-learning process.[2,3]

Population aging in Cuba is a health issue that has been established as a priority program of the Ministry of Public Health due to the care required by this population group. This stage of life predisposes individuals to the onset of diseases and medication consumption. It has been shown that patients over 65 years of age consume two to three times more medications than the general population average, which is why strictly rational use of these drugs is important in these patients.

At this stage of life, the smallest possible number of drugs should be used—those that are most effective and have the fewest side effects—and special attention should be paid to possible drug interactions when several are used simultaneously. Irrational prescribing of medications leads to inappropriate clinical management of the patient, unnecessary risk of undesirable drug-induced effects, and excessive costs. Villa Clara is a province with a high percentage of elderly population, therefore special attention to this problem is necessary.[4]

This research was conducted with the aim of designing a mobile application containing basic information about the most commonly prescribed medications for older adults at the primary health care level.

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METHODS

An applied research study was conducted in the field of technological innovation during the period from January 2024 to December 2025, at the Faculty of Medicine of the University of Medical Sciences Of Villa Clara. From the study universe, a non-probabilistic convenience sample was selected, consisting of 167 users: 14 fifth-year medical students and 135 physicians.

Various methods and techniques were employed in the research, based on the requirements of the dialectical-materialist method.

At the theoretical level:

- Analytical-synthetic: allowed the analysis, from a theoretical perspective, of different studies on mobile technologies, as well as the extraction of the most important elements related to Android applications.
- Inductive-deductive: facilitated the transition from reasoning based on specific knowledge of application development toward a broader understanding of mobile technologies in educational contexts.
- Historical-logical: used to theoretically verify the evolution and trajectory of mobile technologies in the teaching-learning process.
- Modeling: employed as a theoretical method to structure the design process, by abstracting the essential elements of the problem situation through the use of a modeling language that served as the basis for the application's development.

Empirical methods used in the four stages of the research:

First stage: search and compilation of digital and printed content on therapeutics in older adults, and documentary analysis of subject syllabi from the clinical cycle and the Family Medicine specialty, with the aim of understanding theoretical and computing background.

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Second stage: group work was conducted with specialists in Geriatrics, Pharmacology, Family Medicine, and Informatics to analyze the most frequent and prevalent diseases in older adults, the most commonly prescribed medications at the primary care level, and medications — not only from Cuba's basic drug list but also those available in other countries (donated or imported) that are more recently marketed — about which undergraduate and postgraduate students have little knowledge.

Third stage: design of the application GERONTO-APS-FARMA for Android mobile phones, aimed at physicians working in primary care and students rotating through those services. It contains information on medications: presentation, indication, adverse effects, contraindications, precautions, dosage, frequency, route of administration, and drug interactions in older adults.

Fourth stage: the relevance, feasibility, applicability, potential for generalization, and originality of the application were assessed using the criteria of specialists linked to older adult care. The group consisted of 11 specialists: 5 in Pharmacology, 2 in Geriatrics, 3 in Family Medicine, and 1 in Informatics. All held scientific degrees, primary academic titles of full professor or associate professor, and recognized prestige in their professional performance.

They were asked to provide a rating between 1 and 5 for each variable. The application was considered accepted when at least three indicators were rated 5; accepted with difficulties when two indicators were rated 5; and not accepted when the results did not meet the defined criteria.

To assess the functionality of the application, an interview was designed and administered to users. They were asked to provide their opinions on the following variables: design quality, interface aesthetics, ease of use, functionality, and product content (information quality and up-to-datedness). For all variables, the scale used was: Excellent, Very Good, Good, and Insufficient.

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A database was created with the data and analyzed using the SPSS 21.0 statistical package; descriptive statistics were used for the analysis of the results.

Ethical aspects of the research: This research followed the principles and recommendations of the Helsinki Declaration for research.[5] The principles of medical ethics were respected, anonymity was guaranteed, and the information will only be disclosed for scientific purposes and in appropriate settings.

RESULTS AND DISCUSSION

Through the bibliographic review conducted, documentary analysis, and group work, it was confirmed that there are numerous reasons supporting the need to provide more information on the topic of Therapeutics in older adults:

- Population aging in Cuba is a social and health problem, and Villa Clara is among the provinces with the highest percentage of elderly population in the country.
- Elderly individuals have a greater number of diseases and consume more medications, predisposing them to interactions and adverse reactions.
- The curricula for the medical degree and the Family Medicine specialization in the area of older adult care are adequate in terms of content, but their implementation presents difficulties that prevent appropriate comprehensive training of professionals.[6]
- In the authors' opinion, with the advent of ICTs, both medical care and medical education need to make greater use of their educational tools in designing applications useful for those processes. Most students and physicians own mobile phones, like using these technologies, and know how to use them. These reasons constitute the grounds for designing the application described below:

Description of the GERONTO-APS-FARMA application

A mobile application with easy-to-use interfaces was developed to encourage its use and capture users' attention. Figure 1 shows its home screen.

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Fig. 1. Home screen
Source: own elaboration

Fig. 1. shows the main screen, where the names of the authors, the institution, the registration number with the National Association of Innovators and Rationalizers of Cuba (ANIR), and the button to access the application's contents can be seen.

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Fig. 2. Main screen

Source: own elaboration

The GERONTO-APS-FARMA application is designed using the new web standard HTML5. It runs on a wide variety of devices and is independent of the operating system.

The medications were grouped by organ systems: cardiovascular drugs, antimicrobials, non-steroidal anti-inflammatory drugs, gastrointestinal drugs, nervous system drugs, endocrine system drugs, ophthalmological drugs, dermatological drugs, respiratory system drugs, and natural and traditional medicine drugs; and finally, an icon containing the abbreviations used. Figure 3 shows the list of organ systems by which the pharmacological information is grouped.

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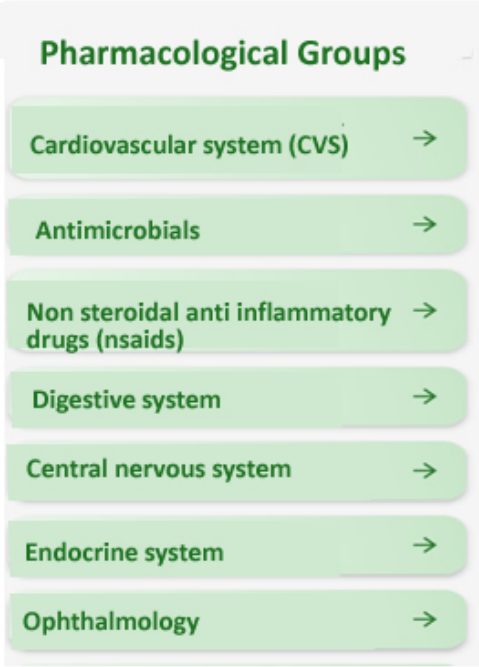

Fig 3. Organ systems by which the pharmacological information is grouped
Source: own elaboration

The criteria of the eleven specialists selected to validate the content system and design of the GERONTO-APS-FARMA application for Android mobile phones are shown in Table 1. It can be seen that three of the dimensions received a score of 5, confirming that the application is highly applicable, generalizable, and novel.

When analyzing feasibility -the dimension that assesses the real possibility of use according to the required technological infrastructure- 36.40 % of the specialists considered it moderately feasible, and 63.60% considered it feasible. In this section, they argued that although it is feasible, a limitation is that it cannot be installed on iPhones.

Regarding relevance, 27.28 % expressed the opinion that it is moderately relevant. They stated that in terms of social value, it is highly relevant, but in relation to the need it addresses, there are other elements that can influence the achievement of quality rational therapeutics, which cannot be achieved solely with the application; it must be accompanied

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by updating, training, and motivation of students and primary care professionals, among other elements.

According to the evaluative categories, the GERONTO-APS-FARMA application is considered accepted, since all the specialists consulted rated at least three of the indicators with a value of 5.

Table 1. Assessment according to specialist criteria of the GERONTO-APS-FARMA mobile application

Dimensions	**Evaluative categories**					
	3		4		5	
	No.	%	No.	%	No.	%
Feasibility	4	36,40	7	63,60	-	-
Applicability	-	-	-	-	11	100
Possibility of generalization	-	-	-	-	11	100
Relevance	-	-	3	27,28	8	72,72
Originality of the product	-	-	-	-	11	100

Source: survey

According to user criteria, this application has been made available to undergraduate students and primary care physicians who care for older adults in their clinical practice. All 167 respondents rated the dimensions of ease of use and product content (which assesses quality and up-to-dateness) as excellent. Design and aesthetics were rated between excellent and good. However, regarding functionality, 20.95 % of users rated it as good and 4.19 % as insufficient, because it could not be installed on their iPhones. This is a restriction for people who own an iOS phone or device for various reasons, including Apple's closed system and the predominance of Android in Cuba as the main conflicting factors with iOS.

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A good application can be helpful if the user interface is well designed, loading time is fast, and data protection is robust; additionally, if users classify it as having excellent technical support-qualities that the designed application meets according to their criteria.

Table 2. User assessment of GERONTO-APS-FARMA

Dimensions	Excellent		Very good		Good		Insufficient	
	No.	%	No.	%	No.	%	No.	%
Design quality	145	86,83	22	13,17				
Interface aesthetics	158	94,61	9	5,39				
Ease of use	167	100						
Functionality	125	74,86			35	20,95	7	4,19
Product content	167	100						

Source: interview

In the 21st century, there has been steady growth in the use of ICTs, especially on mobile devices with access to web applications related to e-commerce, entertainment, productivity, and health topics.[7]

The development of mobile applications has transformed strategies and paradigms established for years; they have become a tool that allows users to carry out activities and manage services from anywhere and at any time. These applications not only streamline processes and care services, but also create direct communication channels between people and allow them to control their income and expenses, purchases, sales, and even business management.[8]

ICTs have improved patient care and revolutionized the training of new professionals. Their integration is key to a more efficient, accessible, and higher-quality healthcare system. These technologies point toward a model of personalized, predictive, preventive, participatory, and population-based medicine.

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The use of educational mobile applications has become a key strategy in the digital transformation of education; however, there are contradictions regarding their influence on learning. Nevertheless, research results[9] indicate that these applications help increase motivation and academic performance. It is considered that these applications have high transformative potential as long as their implementation is based on solid didactic foundations and appropriate educational conditions.

Likewise, the training of health professionals has been modernized thanks to digital tools that complement and enrich traditional learning. Mobile applications provide rapid access to quality, up-to-date medical information.

ICTs are a fundamental pillar in the present and future of healthcare. In clinical care, they optimize processes, personalize treatments, and bring services closer to patients. In education, they offer innovative methods that improve skill acquisition.[10] It is necessary to train teachers and healthcare professionals in the pedagogical and clinical use of new tools, not only in their technical handling.

The idea of designing this mobile application arose from the need to provide accessible, fast, and updated information on the most appropriate medications for the older adult population. Regarding medication use in geriatric patients, there is a Colombian application called GeriatiApp[10] that offers a structured and rapid protocol for comprehensive assessment, with an emphasis on detecting inappropriate polypharmacy using STOPP/START criteria. However, its limitation is that it is not a drug database for consulting dosages, details of drug interactions, and precautions in older adults; this is where the main value of the designed tool lies — that is, there is no evidence of a mobile application that provides the information offered by the GERONTO-APS-FARMA product.

The functionality assessment according to user criteria coincides with the usability evaluation study conducted by Couoh Novelo[11] at the Technological Institute of Tizimín, Mexico. In similar studies, the results showed acceptance, meaning that the application positively fulfills the described usability variables.[12,13,14]

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In the authors' opinion, the GERONTO-APS-FARMA App is a computing tool that offers instant access to information on the most commonly used medications in older adults. It provides a novel way to access information on presentation, indication, adverse effects, contraindications, precautions, dosage, frequency, route of administration, and drug interactions in older adults-aspects that are essential to avoid errors in the prescribing process and thereby prevent adverse effects, irrational prescriptions, and drug interactions. Having this information on a mobile device saves time, increases effectiveness, and improves the quality of medication prescribing in older adults.

GERONTO-APS-FARMA is not a closed platform; its design allows new content to be added through regular updates. It contains attractive, easy-to-use interfaces that encourage its use and capture users' attention, and it does not require connectivity to be used. It constitutes a source of information on the most commonly used medications for older adults at the primary care level.

Mobile devices have become a new social, cultural, and educational paradigm that cannot be overlooked in education. Mobile phones, tablets, laptops, etc., can all be used from an educational perspective. [15]

It is argued that the success of a mobile application is not directly proportional to how complex it is; the easier its functionality, the greater its success. Loading speed and responsiveness are key characteristics of a good application. It also requires frequent updating due to the large volume of new and changing content. Currently, mobile applications have become society's main communication channel; they are versatile and effective for obtaining important and reliable information at any time, with updated content-characteristics that the designed application fulfills.

Scientific contribution

The GERONTO-APS-FARMA application is a novel, accessible, and simple tool that offers information on the most commonly used medications for treating the most frequent diseases

in older adults, and is very useful for professionals working in primary healthcare and healthcare professionals in general.

CONCLUSIONS

A mobile application was designed that offers a fast and frequently updated information alternative on the most appropriate medications for older adults at the primary care level, which was evaluated satisfactorily according to the criteria of specialists and users.

BIBLIOGRAPHIC REFERENCES

1. Pacora Camargo LA. CHECKEATE, aplicación tecnológica en la prevención y tratamiento de las enfermedades crónicas no transmisibles. Rev Cuba Inf Cienc Salud [Internet]. 2021 [cited 17/08/2024];32(2):[aprox. 16 p.]. Available at: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2307211320210002000013&lng=es

2. Fuentes-Pacheco N, Hernández-Rincón E, Barbosa-Ardila S, Cadavid-Dávila A. Aplicaciones móviles educativas en salud que surgieron durante el período 2020-2022 en Colombia. Rev Cubana de Información en Ciencias de la Salud [Internet]. 2023 [cited 17/08/2024];34:[aprox. 18 p.]. Available at: https://acimed.sld.cu/index.php/acimed/article/view/2328

3. Viton Castillo A, Lazo Herrera A. Uso de las tecnologías de la información y las comunicaciones en la carrera de Enfermería. Rev Ciencias Médicas de Pinar del Río [Internet]. 2019 [cited 16/07/2024];23(3):446-53. Available at: http://www.revcmpinar.sld.cu/index.php/publicaciones/article/view/3943

4. Alemañy-Pérez E. Retos en la formación del médico general integral ante el cambio demográfico en Cuba. Rev Información Científica [Internet]. 2022 [cited 11/04/2025];101(Suppl 2):e3900. Available at: https://revinfcientifica.sld.cu/index.php/ric/article/view/3900/5415

5. Asociación Médica Mundial. Unidad de Ética: Declaración de Helsinki de la Asociación Médica Mundial. Principios éticos para las investigaciones médicas en seres humanos. 75 AG,

Helsinki, Finlandia; 2024. Available at: http://www.wma.net/es/policies-post/declaracion-de-helsinki-de-la-amm-principios-eticos-para-las-investigaciones-medicas-en-seres-humanos/

6. Zayas González M, Martínez Fernández F, Pérez Rivero Y, Viñet Cordovez O, González Rodríguez JE, Milá Aguilera AO. Terapéutica de enfermedades más frecuentes en el adulto mayor: necesidades educativas en estudiantes de Medicina. EDUMECENTRO [Internet]. 2024 [cited 16/01/2026];16:e2903. Available at: http://scielo.sld.cu/pdf/edu/v16/2077-2874-edu-16-e2903.pdf

7. Acosta Espinoza L, León Yacelga AR, Germánico Sanafria W. Las aplicaciones móviles y su impacto en la sociedad. Univers y Soc [Internet]. 2022 [cited 01/16/2026];14(2):237-243. Available at: http://rus.ucf.edu.cu/index.php/rus/article/view/2697

8. García López I, Blanco Barbeito N, La Rosa Hernández N, Amechazurra Oliva M, Torres Pérez G, Martínez Franco JL. Histoweb: una herramienta educativa para la enseñanza de Historia de Cuba en ciencias médicas. EDUMECENTRO [Internet]. 2021 [cited 11/04/2025];13:(4):[aprox. 17 p.]. Available at: https://revedumecentro.sld.cu/index.php/edumc/article/view/1870

9. Mieles Moreira G, Mendoza Suárez AD, Delgado Cabrera LM, Cantos Pinagorte MM, Sornoza Zambrano SI, Menéndez Zamora SB. Uso de aplicaciones móviles educativas en el aprendizaje escolar. Sinergia Académica [Internet]. 2026 [cited 13/05/2026];9(4):667-82. Available at: https://sinergiaacademica.com/index.php/sa/article/view/1046

10. Cervantes López M, Pana Maldonado A, Ramos Sánchez A. Uso de las tecnologías de la información y la comunicación como herramienta de apoyo en el aprendizaje de los estudiantes de medicina. CienciaUAT [Internet]. 2020 [cited 18/12/2025];15(1):162-171. Available at: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid+S2007-78582020000020016&Ing=es

11. Bautista HA, Parafán D, Torres C, López JH. Presentación de GeriatriApp: una app para la evaluación geriátrica integral en español. Aten Prim [Internet]. 2020 [cited 18/12/2025];52(6):369-446. Available at: https://doi.org/10.1016/j.aprim.2019.07.011

12. Couoh Novelo MA. Evaluación de usabilidad en herramientas de aprendizaje colaborativo en dispositivos móviles para ambientes virtuales educativos. Rev Iberoam Investig Desarro

Educ [Internet]. 2021 [cited 18/12/2025];11(22):[aprox. 18 p.]. Available at: https://doi.org/10.23913/ride.v11i22.931

13. Romero Jama GG, Torres Burgos SA, Guerrero Llerena MF, Coello Romero DC. Las aplicaciones móviles como recurso en la enseñanza del docente de Lengua y Literatura. Rev Universidad, Ciencia y Tecnología [Internet]. 2024 [cited 05/01/2026];(número especial):[aprox. 10 p.]. Available at: https://doi.org/10.23913/ride.v11i22.931

14. Velázquez Hidalgo AS, Fernández Pérez Y, Pacheco Jérez YP, Zulueta Véliz Y. Métodos y criterios para valorar la calidad en uso de las aplicaciones móviles para atención al ciudadano cubano. RCCI [Internet]. 2023 [cited 05/01/2026];17(3):[aprox. 15 p.]. Available at: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2227-18992023000300007&lng=es&tlng=es

15. Flores del Castillo EY, Portal Valdivia CM. Dispositivos móviles en el aula: experiencias para la enseñanza en la Universidad de Sancti Spíritus. Referencia Pedagógica [Internet]. 2023 [cited 05/01/2026];11(2):200-211. Available at: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2308-30422023000200200&lng=es&tlng=es

Declaration of interests

The authors declare no conflict of interest.

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