Revista Información Científica

ISSN 1028-9933
Universidad de Ciencias Médicas de Guantánamo

March 2025 Volume 104 e4891
DOI: https://doi.org/10.5281/zenodo.14701364

ORIGINAL ARTICLE

Prototype of a mobile application to prevent cardiovascular risk in older adults

Prototipo de aplicación móvil para prevenir riesgo cardiovascular en adultos mayores

Protótipo de aplicativo móvel para prevenção de risco cardiovascular em idosos

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Received: 30-11-2024 **Accepted:** 01-03-2025 **Published:** 14-03-2025

ABSTRACT

Introduction: currently, cardiovascular diseases are the leading cause of death worldwide. Cardiovascular devices play a crucial role in heart health care. They are designed to monitor, diagnose, and treat various heart conditions. However, further studies are still needed. **Objective:** to evaluate the use of a mobile application prototype for cardiovascular risk prevention in older adults. **Method:** a sample of 46 patients was selected from the MINSA CAPSI (National Health Service of El Coco) and the Association of Retirees and Pensioners (Asociación de Jubilados y Pensionados), both from La Chorrera. After a detailed explanation, they were surveyed about the study prototype. The variables analyzed were: sex, cardiovascular disease status, other diseases status, prototype use, opinions about the prototype, important aspects of the prototype, and comfort. **Results:** males were predominant (76%), 61.1% of the sample suffered from cardiovascular disease, with diabetes mellitus (39.13%) and high blood pressure (34.78%). Respondents stated that the device was comfortable, most aspects were important, and they considered it excellent in their opinion, although some features could be improved. **Conclusions:** the acceptance and interest expressed by users suggest that, with proper implementation, this technology could play an important role in reducing risk factors in the older population.

Keywords: cardiovascular diseases; prototype; older adults; cardiovascular device; mobile application

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RESUMEN

Introducción: en la actualidad las principales causas de muertes a nivel mundial son las enfermedades cardiovasculares. Los dispositivos cardiovasculares desempeñan un rol crucial en el cuidado de la salud del corazón. Están diseñados para monitorear, diagnosticar y tratar diversas afecciones cardíacas. Sin embargo, aún es necesario mayores estudios. **Objetivo:** evaluar el uso de un prototipo de aplicación móvil para la prevención del riesgo cardiovascular en adultos mayores. **Método:** se seleccionó una muestra de 46 pacientes del MINSA CAPSI de El Coco y la Asociación de Jubilados y Pensionados, ambos de La Chorrera. Luego de una explicación detallada se les realizó una encuesta sobre el prototipo de estudio. Las variables analizadas fueron: sexo, padecimiento de enfermedades cardiovasculares, padecimiento de otras enfermedades, uso del prototipo, opinión del prototipo, aspectos importantes del prototipo y comodidad. **Resultados:** prevaleció el sexo masculino (76 %), el 61,1 % de la muestra padeció enfermedades cardiovasculares, con diabetes mellitus (39,13 %) e hipertensión arterial (34,78 %). Los encuestados manifestaron que el dispositivo era cómodo, la mayoría de los aspectos resultaron importantes y que lo consideraban excelente desde su opinión, aunque podían mejorarse algunas funciones. **Conclusiones:** la aceptación y el interés manifestado por los usuarios sugieren que, con una implementación adecuada, esta tecnología podría jugar un importante rol en la reducción de factores de riesgo en la población mayor.

Palabras clave: enfermedades cardiovasculares; prototipo, adulto mayor; dispositivo cardiovascular; aplicación móvil

RESUMO

Introdução: atualmente as principais causas de morte no mundo são as doenças cardiovasculares. Os dispositivos cardiovasculares desempenham um papel crucial nos cuidados de saúde cardíaca. Eles são projetados para monitorar, diagnosticar e tratar diversas doenças cardíacas. No entanto, mais estudos ainda são necessários. **Objetivo:** avaliar a utilização de um protótipo de aplicativo móvel para prevenção de risco cardiovascular em idosos. **Método:** foi selecionada uma amostra de 46 pacientes do MINSA CAPSI de El Coco e da Associação de Aposentados e Pensionistas, ambos de La Chorrera. Após uma explicação detalhada, foi realizado um levantamento sobre o protótipo do estudo. As variáveis analisadas foram: sexo, sofrer de doenças cardiovasculares, sofrer de outras doenças, uso do protótipo, opinião sobre o protótipo, aspectos importantes do protótipo e conforto. **Resultados:** prevaleceu o sexo masculino (76%), 61,1% da amostra sofria de doenças cardiovasculares, com diabetes mellitus (39,13%) e hipertensão (34,78%). Os entrevistados afirmaram que o aparelho era confortável, a maioria dos aspectos eram importantes e que o consideravam excelente, embora algumas funções pudessem ser melhoradas.**Conclusões:** a aceitação e o interesse manifestados pelos utilizadores sugerem que, com uma implementação adequada, esta tecnologia poderá desempenhar um papel importante na redução dos fatores de risco na população idosa.

Palavras-chave: doenças cardiovasculares; protótipo, idoso; dispositivo cardiovascular; aplicativo móvel

How to cite this article:
Abrego Santana EM, Vallejos Marín EM, Marín Monterrey MM, Fung Corro JR, Carrasquillal I. Prototype of a mobile application to prevent cardiovascular risk in older adults. Rev Inf Cient [Internet]. 2025 [cited Access date]; 104:e4891. Available at: http://www.revinfcientifica.sld.cu/index.php/ric/article/view/4891

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INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of death worldwide. Despite advances in the understanding of risk factors and the development of effective treatments, the prevalence of CVD remains high. This is due in large part to the prevalence of unhealthy lifestyles and inadequate management of cardiovascular risk factors.[1,2,3,4]

These diseases are also on the rise in Panama, due to lifestyle, work stress and the pandemic; as depression and anxiety disorders have increased, which affect the cardiovascular system and manifest as heart attacks.[5,6]

During the last decade, the estimation of individual cardiovascular risk has become the cornerstone of prevention guidelines for the global management of risk factors in clinical practice. Cardiovascular risk establishes the probability of suffering a cardiovascular event in a certain period, generally 5 or 10 years. There are currently multiple systems available for estimating cardiovascular risk. Mathematical models assign different weights to each of the major risk factors (sex, age, blood pressure, smoking, diabetes, total cholesterol levels, low-density lipoprotein and high-density lipoprotein) for developing cardiovascular disease within a given period of time.[4,7]

In general terms, health care based on telemedicine and portable devices that integrate all the information provides the opportunity to redesign and improve the care of patients with cardiovascular disease. However, such tools must be regulated by the competent authorities, as they are devices for medical use.[8,9]

Particularly, small data randomized and controlled trails, and meta-analyses demonstrate a significant improvement in risk factors with telemedicine, although the durability of the interventions is not well defined. The global approach to cardiovascular risk factors has been comprehensively assessed in cardiac rehabilitation programs and the guidelines recommend telemedicine as a valid option in follow-up to increase long-term adherence.[8]

In this sense, it is necessary to increase the scientific evidence on the subject. The following study aims to evaluate the perception and acceptance of a prototype mobile application for cardiovascular risk prevention in older adults.

METHOD

The population in this study consisted mainly of older and middle-aged adults with or without cardiovascular problems. Hence, they were divided into two major groups: older adults with CVD, elderly and adults without cardiovascular problems.

The research was conducted in the period January - August 2024, with a sample of 46 participants: 14 were recruited through the Association of Retirees and Pensioners, while 32 participants were volunteers at the MINSA CAPSI El Coco (community health center), both from La Chorrera, Panama. These centers were selected because of their proximity, accessibility and that they offer services to a large number of elderly people.

To ensure that the study sample was representative and relevant to the target population, specific inclusion and exclusion criteria were established (Table 1). These criteria ensured that the participants had characteristics relevant to the analysis of the feasibility and acceptability of the cardiac monitoring prototype, which allowed useful and applicable results to be obtained for potential users of the device.

Inclusion criteria:

- ✓ Age: participants had to be older adults of with an age approaching 60 years or older.
- ✓ Medical condition: two groups were included: older adults with cardiovascular problems and healthy older adults with no history of heart disease.
- ✓ Ability to participate: participants had to be able to understand the prototype demonstration and complete a feedback survey. Only those who could give informed consent in a consciously and voluntarily way were included.
- ✓ Interest in the prototype: individuals were selected who showed interest in the cardiac monitoring technology. This ensured that the opinions obtained came from people who actually considered such a device useful.

Exclusion criteria:

- ✓ Age younger than 60 years
- ✓ Inability to actively participate
- ✓ Lack of informed consent: those who were unable or unwilling to provide informed consent to participate in the study were excluded, respecting the ethical principles of the research
- ✓ Disinterest in medical technology: those who expressed no interest in health monitoring using medical devices were excluded, as their participation could bias the results of the feedback regarding the acceptance of the prototype

To evaluate the impact of a prototype mobile application, a meticulous data collection process was carried out through surveys of volunteer participants. Google Forms was used for the questionnaire application.

The qualitative questions were designed to allow participants to express their opinions and suggestions in an open-ended manner, which provided a richer and more nuanced understanding of their experience. On the other hand, the quantitative questions allowed for the collection of measurable data, facilitating statistical analysis and the identification of common trends among users.

The survey took into account several aspects such as gender, patients with or without CVD and other diseases; as well as the opinion about the prototype, important aspects of the prototype, comfort and use.

For the evaluation, a detailed explanation of the prototype's functionality was first presented and then the survey was administered. During the explanation, key aspects of the device were highlighted, such as the functionalities of its sensors and the work done with the different components.

RESULTS

The group of older adults with cardiovascular disease accounted for 61.1% of the study participants. In turn, those without such disease accounted for 39.9%.

Figure 1 shows a greater representation of men, which accounted for more than three quarters of the sample (76%).

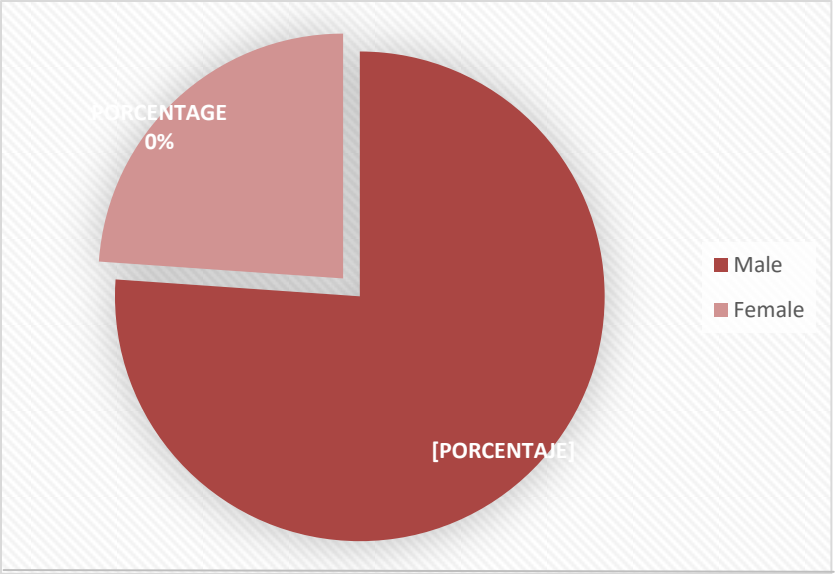

Fig.1: Representation of the sample surveyed by sex in the study of the use of the prototype mobile application for the prevention of cardiovascular risk in older adults

Figure 2 shows diabetes mellitus (39.13 %) and HT (34.78 %) as the diseases concurrent with CVD in older adults. In addition, it can be seen that in the study sample in general there are subjects who presented more than one condition.

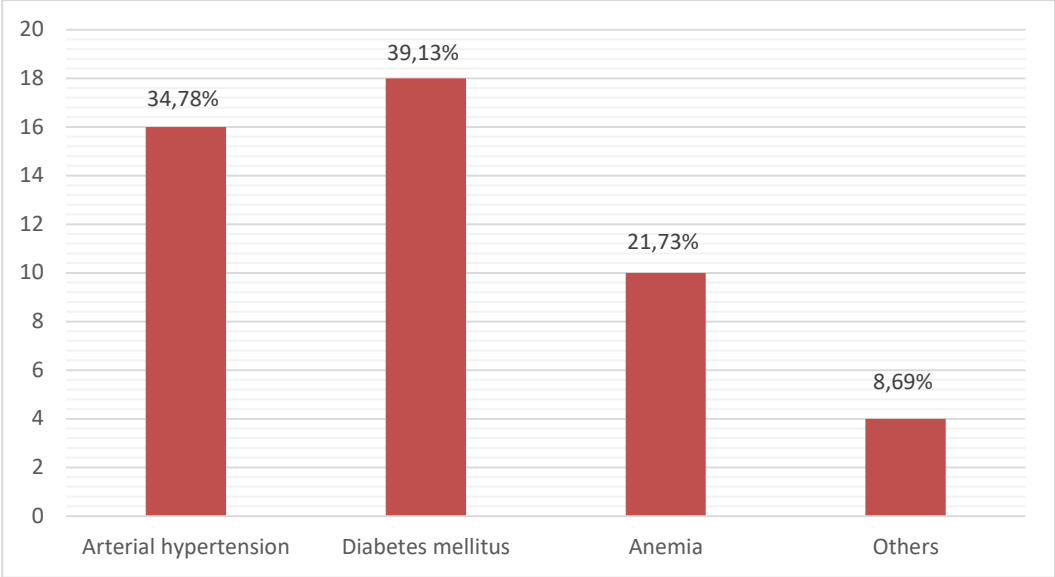

Fig.2. Concurrent diseases with cerebrovascular disease in the study population

Overall, the results shown in Figure 3 showed favorable acceptance of the prototype.

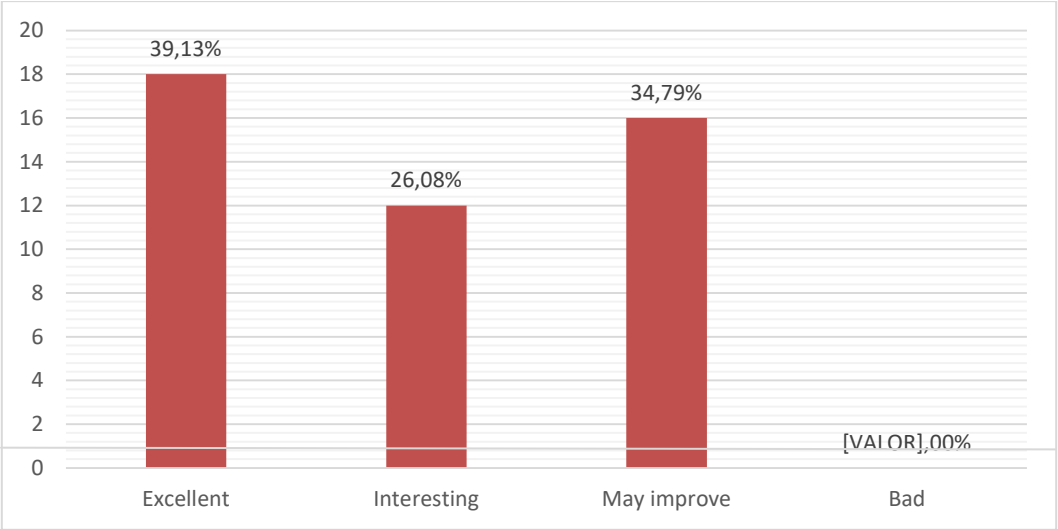

Figure 3: Respondents' opinion of the prototype mobile application for cardiovascular risk prevention in older adults

According to the data shown in Figure 4, the prototype is generally considered important; although blood pressure monitoring was highlighted as the most relevant individual element (30.43 %).

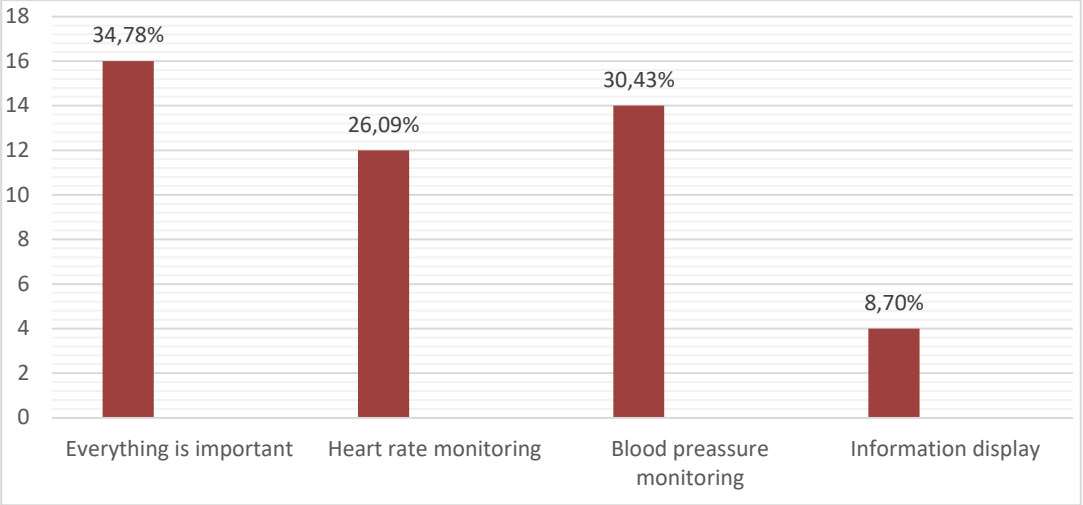

Fig. 4: Respondents' answers regarding the aspects they considered most important in the prototype mobile application for the prevention of cardiovascular risk in older adults

On the other hand, 93% of the subjects stated that they would find the device comfortable to use, while 7% stated that they could not perceive total comfort in the equipment shown. Ninety-one percent of respondents said they would use the device, compared to 9% who said they would not use the device.

DISCUSSION

The inclusion of both people with and without cardiac conditions allowed us to obtain a comprehensive view of how the device might perform in real situations of use. In future research, it would also be of interest to explore the population of older adults without CVD only, to evaluate a preventive approach with the prototype.

Likewise, the implementation of a more random or stratified sampling could be considered to obtain a greater generalization of the results. However, at this stage, convenience sampling provided a clear and practical view on the feasibility of the prototype among those who, by their characteristics, would be the main users of the device.

The results show that the major associated disease presented was diabetes, followed by HTN. This contrasts with the results of the literature. According to several authors, diabetes is related to cardiocirculatory diseases, it is considered an important cardiovascular risk factor, which increases it, as well as premature death.[10]

Similarly, HTN is a prevalent disease in the elderly and a risk factor associated with an increase in cardiovascular morbidity and mortality rates a high consumption of health care resources, and a deterioration in the quality of life of patients.[1,2,11,12]. The main objective of treatment of hypertensive patients is to achieve the maximum reduction in long-term cardiovascular risk.[12]. On the other hand the male sex showed a greater predisposition to suffer from CVD.

On the other hand, the male sex presented a greater predisposition to suffer CVD. This contrasts with previous studies that have shown that the risk of disease and prevalence of CVD is higher in men than in women.[2]

Developing a prototype that is well received by users is a task that goes far beyond simple technical functionality. The high rating of the prototype in means that not only do they find it functional, but they also find its design attractive and its use simple; although it is also highly rated in the "Can Improve" section, which denotes the need for further refinement in future versions.

The interpretation of the data also allowed us to evaluate the use of the prototype and comfort. It analyzed how users interacted with the application and whether they encountered any difficulties in using its features. The evaluation of usage is critical to ensure that the prototype provides a smooth and efficient user experience, which in turn can influence the acceptance and success of the application in the market. In addition, user satisfaction was a key aspect of the analysis.

In that sense, although the results reflect satisfactory values for both indicators, it is important to take into account the population group that still sees difficulties in its use and comfort, in order to make technological, interface or other improvements that will allow them to be accepted by a larger population. All this will necessarily have an impact on the availability of another tool for the estimation of CVD risk factors and, consequently, on the health of the population.

Although all the parameters in general were of interest, the follow-up of HT showed special relevance. This showed the education of the study population on the subject.

This parameter has been extensively studied in telemedicine[9], as it continues to increase in cardiovascular morbidity and mortality due to the lack of control (linked to poor adherence to antihypertensive treatments) and its high ¨burden¨ (as a non-transmissible disease).[9,12] It is therefore necessary to further improve computational methods and their integration into computer programs.

The analysis of the respondents' perception allowed us to explore in depth how older adults perceive and accept new technologies that could transform their well-being. The results obtained not only validate the prototype design, but also reveal key insights for its future implementation and success; although direct intervention is recommended for further research, which will allow for the evaluation of other more specific factors. This approach is essential to obtain a clear and detailed view of how users interact with the prototype and how they perceive its features and functionalities.

These results allowed us to identify the strengths of the prototype, such as features that are well received and valued by users, as well as weaknesses, such as functionalities that present difficulties or dissatisfaction. This information is crucial to guide the iteration and improvement process of the prototype, ensuring that the modifications made are aligned with the needs and expectations of the users.

Several factors influence the use of a device. One of the key points in these analyses is how users respond to the visual design of the prototype. The appearance of the device can influence patients' willingness to adopt it. A design that is visually appealing and conveys safety can increase users' confidence and willingness to use the device regularly. In our analyses, we have observed that patients respond more positively to prototypes that are visually.

Acceptance is also linked to ease of use. A device could be advanced technically, but if it is not intuitive and easy to use, its acceptance will be limited.

And, particularly during this investigation, the way the prototype was explained and presented to the subjects influenced how they perceived it. If the information is clear, concise and relevant, patients have a better understanding of how the device can benefit them. This, in turn, improves their willingness to accept it and integrate it into their daily lives.

On the other hand, the calculation of individual cardiovascular risk is of clinical importance for the following reasons: a) it is a useful tool for identifying high-risk patients who deserve intensive and early attention and intervention; b) it serves to motivate patients to comply with hygienic-dietary and pharmacological measures; c) it serves to modulate the intensity of efforts to control cardiovascular risk factors according to the evolution of risk over time.[7] Hence, the above highlights the relevance of the research, which is able to perform a remote analysis and allows the evaluation of a larger population with remote devices.

The present research reflects that it is not only focused on satisfying technical expectations, but that the device also provides a pleasant and satisfying experience for the users. This goal implies a holistic approach to prototype development. It is not enough for the device to work properly; it must also be something that patients want to use, that provides value in their daily lives, and that they do so in a way that they are comfortable. One of the biggest challenges you face is balancing functionality with user experience. This approach requires a constant return to graphical analysis to verify how new features are perceived by users.

Further development of the prototype is recommended, with the incorporation of valuable feedback obtained from potential users. Furthermore, future additional research is suggested to validate the efficacy and accuracy of the prototype in real clinical settings, focusing on controlled trials and more in-depth evaluations of the impact of the prototype on cardiovascular risk reduction, always in strict compliance with established ethical guidelines. The acceptance demonstrated by older adults constitutes a solid starting point for its eventual implementation, offering a promising tool for the prevention of cardiovascular disease in this vulnerable population.

CONCLUSIONS

The positive perception of the developed prototype by older adults is highlighted, underscoring its potential as an effective tool for the prevention of cardiovascular risks. The acceptance and interest shown by users suggest that, with proper implementation, this technology could play a crucial role in the reduction of risk factors in the elderly population. These findings reinforce the need to continue to develop solutions that are not only technically feasible, but also have the acceptance of those who need them most.

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Conflicts of interest:
The authors declare that there are no conflicts of interest.

Authors' contribution:
Eric Magdiel Abrego Santana: conceptualization, formal analysis, fund acquisition, research, methodology, project management, resources, validation, visualization, writing - review and editing
Elbis Miguel Vallejos Marín: data curation, research, methodology, writing - original draft, writing - revision and editing
Mitzy Mariley Marín Monterrey: data curation, research, methodology, validation, writing - original draft, writing - review and editing
José Rogelio Fung Corro: formal analysis, research, supervision, writing - original draft, writing - review and editing
Indira CarrasquillaI: visualization, writing - original draft, writing - review and editing

Financing:
No funding was received for the development of this article.

Complementary file (Open Data):
Propuesta de guía para la elaboración de un cuestionario sobre la evaluación del uso de un prototipo para la prevención del riesgo cardiovascular en adultos mayores