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Disseminating cardiovascular disease risk assessment with a PAHO mobile app: a public eHealth intervention

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ABSTRACT *Cardiovascular diseases are the leading cause of death in the Region of the Americas, making cardiovascular risk assessment a critical component of the clinical decision-making process. This process is facilitated by the use of appropriate tools.*

This article presents the technical characteristics of an application (app) developed by the Pan American Health Organization/World Health Organization (PAHO/WHO) for mobile devices and computers. Called the Cardiovascular Risk Calculator, it is based on WHO risk tables and applied to the countries of the Region. The article details the epidemiological basis of the diagram for predicting cardiovascular risk and describes the app and its four modules, its main audiences, its production process, and finally, the initial results and some of the challenges.

Four months after its launch, the application was being used daily by more than 12 000 users and had been downloaded in virtually all the countries of the Region. The app can be used in by physicians, nurses, and other technical personnel in their daily practice, especially at the primary care level. Since it can also be used by the general public, special attention was paid to its design and tutorial and to ensuring that the clinical estimates and recommendations were easy to understand. This type of app facilitates communication between health care providers and users, and its systematic use in the health services, especially in primary care services, should be promoted.

Key words Cardiovascular diseases; primary health care; risk management; technology assessment, biomedical; Americas.

Cardiovascular diseases (CVD; International Classification of Diseases, 10th edition [ICD-10], I00-I99) account for about one-third of all deaths in the Region of the Americas. This means that every year, nearly 1.6 million people die from these causes; and 30% of these deaths occur before 70 years of age. In upper-middle- and lower-middle-income countries, cardiovascular mortality is 20% and 57% higher, respectively, than in high-income countries (1).

The overall risk of suffering from cardiovascular diseases is determined by the combined effect of socioeconomic determinants, age, gender, and various cardiovascular risk factors that tend to coexist and act multiplicatively. Cardiovascular risk prediction is of critical importance in addressing these diseases, offering a useful decision-making tool for timing and dosages in clinical interventions. Accordingly, people with high cardiovascular risk will see more benefit in terms of the number of avoided events. This approach is particularly appropriate in resource-limited settings where it is imperative to save the greatest number of lives at the least possible cost (2).

In this context, the World Health Organization (WHO) has decided to focus on high-risk groups, while continuing to promote therapeutic decision-making based on individual risk levels, not on arbitrary criteria. WHO also encourages

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interventions based on risk stratification, which is less expensive and more effective than basing decisions on single risk factors (3). Furthermore, the evidence suggests that it is viable to expand multidrug therapy in patients with high cardiovascular risk, and there is agreement that this is one of the most cost-effective interventions (4–5).

Current guidelines focus on selecting non-pharmacological and pharmacological treatment strategies for individual patients according to risk profiles rather than, for example, the individual's cholesterol level, except when levels are very high (6). Despite all the arguments for cardiovascular risk assessment, many people are still unaware of their cardiovascular risk level, many professionals still do not offer their patients this type of assessment, and many countries still do not include cardiovascular risk assessment in the group of services offered at the first level of care (7).

Consistent with these needs and with the emphasis that the Pan American Health Organization (PAHO) has put on eHealth initiatives (8–11), its Department of Noncommunicable Diseases and Mental Health undertook the design of an application (app) for mobile devices and computers to facilitate the calculation of cardiovascular risk, to be used both by health services and the general public. By the end of 2013, smartphones were being used by 20% of the population in Latin America and the Caribbean and this figure is expected to reach 44% by 2017 (12). Also, ambulatory medicine is increasingly computerized and the public increasingly consults the Internet for resources on medical problems.

This article presents the technological features of the app, the epidemiological underpinnings of the cardiovascular risk prediction chart and of the app itself, a description of the app and its four modules, its primary audiences, the process of producing the app, the initial results, and some of the challenges faced.

The app: the PAHO/WHO CV risk calculator

The PAHO/WHO CV Risk Calculator is the app version of the cardiovascular risk prediction chart already developed by WHO (3). The chart is based on averages of risk factors and on average rates of cardiovascular episodes over 10 years in the countries of the subregion defined as "Region of the Americas B" (Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, El Salvador, Grenada, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela), which is where the vast majority of the countries of the Region are located. The WHO chart provides only approximate calculations of cardiovascular risk in people without ischemic heart disease, stroke, or other atherosclerotic diseases. These calculations represent the average for a subregion or country (3).

The PAHO/WHO CV Risk Calculator is free of charge and offers parameters, commands, and tutorials in Spanish, English, and Portuguese. It is a mobile app that can be used on a wide range of smartphones and tablets with different operating systems: Android (version 2.4 or higher), Apple (iOS 6.0 or higher), and BlackBerry (version 10 or higher), and on personal computers (Windows XP or higher, Internet Explorer 10 or higher, 2 GB of RAM, and 50 MB of hard drive space). The app can be downloaded from several websites for offline use with no need for an Internet connection.

The app has four modules. The main one, for which the app is named, lets users calculate their cardiovascular risk. Users can enter gender, age, tobacco use (yes/no), systolic blood pressure, diabetes (yes/no), and cholesterol level. It uses these parameters to predict cardiovascular risk in the next 10 years and shows the result of the calculation along with an explanation (low risk: <10%, moderate: 10–19.9%, high: 20–29.9%, very high: 30–39.9%, and critical: ≥40%) and a color for each risk level (green, yellow, orange, red, and purple, respectively), as it appears in the original WHO chart (3). This is accompanied by simple and specific recommendations for reducing risk, if necessary. The risk estimate is more precise if blood cholesterol level is included, but the calculation can be done without that variable.

The second module calculates Body Mass Index (BMI), letting users know if they are normal weight, overweight, or obese. Both modules allow users to change certain parameters to find out how the likelihood of a cardiovascular event would change if any of their risk factors changed, and how much weight they would have to lose in order to be normal weight.

The third module provides more information on the concept of cardiovascular risk and specific recommendations for tobacco cessation, dietary changes, physical activity, weight control, and the use of alcohol and various medications. The fourth module offers the option to set an alarm to remind users to take their medications.

The app can be used in daily practice by physicians, nurses, and other technical personnel in the health field, especially at the first level of care. Since it can also be used by the general public, special attention was given to its simple design, clear tutorial, and easy-to-understand estimates.

In short, this tool helps health providers make quick estimates of their patients' situation and advise them on strategies to reduce the likelihood of developing one of these diseases. While the app does not attempt to replace medical consultation, it is easy for people other than health professionals to use; if necessary, they can contact a physician for care. The underlying idea is for the app to be attractive both to health providers and the general public, so that they interact more actively and with greater awareness to evaluate CVD risk and make subsequent changes to improve risk profiles. This, in turn, will help improve the general health of those with both the need and desire to make changes.

Development of the app

The app was based on the WHO cardiovascular risk prediction chart mentioned above (3) and an algorithm was developed to reproduce the chart accurately. This algorithm was initially developed in Excel and then converted to a test format by the developers.

The evaluation consisted of comparing the test app to its benchmark (the WHO risk chart). This was done in a university hospital under the supervision of two cardiologists specialized in this type of evaluation. One hundred hypothetical clinical cases were prepared and randomly distributed among five physicians and technical staff members (20 cases each). Each of the 100 cases was evaluated using both the test app and the WHO chart. In all 100 cases, there was complete

concordance, after correcting one data entry error and four color-coding errors in the chart. This ensures that the app's algorithm accurately reproduces the one used in the WHO chart. Furthermore, the app was esthetically attractive, user-friendly, and intuitive. Based on these criteria, the final version of the app was deemed to be ready.

Initial results

The PAHO/WHO CV Risk Calculator was officially launched by PAHO on World Heart Day, 29 September 2014. It is available at the PAHO website (13) and also at the Apple Store and Google Play. Since its launch, it has been downloaded by 12 000 users, with an average of 100 downloads per day, a trend that remained stable after four months, though still highly concentrated in three countries: 40% of the downloads were in Argentina, and 24% in Colombia and Mexico combined. The PAHO news release on the app's launch was published in many countries and an article also appeared in one of Argentina's leading daily newspapers. Brazil still accounts for a very small percentage of the downloads (1.4%), considering the size of its population, but this may be due to the fact that the Portuguese version only became available very recently. The app has been downloaded in almost all the countries of the Caribbean, but in very low proportions, despite its availability in English. Several scientific societies have included it as resource on their websites, including the Inter-American Society of Cardiology (SIAC) and the Argentine Society of Cardiology (SAC).

PAHO is seeking new communication strategies, such as forging partnerships with the main stakeholders who can help ensure that this product reaches the greatest possible number of users in the shortest time. Professional societies, networks of medical and nursing schools, associations of patients, the news media, and social networks can all play a role in promoting its use.

Despite the many benefits of disseminating an app such as this, especially one that facilitates communication between suppliers and users, there is no guarantee that it will be used systematically. For this reason, as the app becomes more well-known, it is necessary to promote its systematic use among the health services. Beyond simply making this tool available, the intervention's ultimate goal reflects the PAHO recommendation to policy makers, particularly regarding primary health services (14). Further research is needed to evaluate the tool's applicability and acceptance and to measure the impact of this type of initiative on eHealth, with a view to improving health practices, empowering users, and ultimately, achieving better clinical outcomes.

Conflicts of interest. None

Disclaimer. Authors hold sole responsibility for the views expressed in the manuscript, which may not necessarily reflect the opinion or policy of the RPSP/PAJPH and/or PAHO.

REFERENCES

1. de Souza MDFM, Gawryszewski VP, Orduñez P, Sanhueza A, Espinal MA. Cardiovascular disease mortality in the Americas: current trends and disparities. Heart. 2012;98(16):1207–12.
2. Mendis S, Lindholm LH, Anderson SG, Alwan A, Koju R, Onwubere BJ, et al. Total cardiovascular risk approach to improve efficiency of cardiovascular prevention in resource constrained settings. J Clin Epidemiol. 2011;64(12):1451–62.
3. World Health Organization. Prevention of cardiovascular disease: Guidelines for assessment and management of cardiovascular risk [Internet]. Geneva: World Health Organization; 2007. Available from: http://www.who.int/cardiovascular_diseases/publications/Prevention_of_Cardiovascular_Disease/en/ Accessed on 10 October 2014.
4. Gaziano TA, Galea G, Reddy SK. Scaling up interventions for chronic disease prevention: the evidence. Lancet. 2007;370:1939–46.
5. Lim SS, Gaziano TA, Gakidou E, Reddy KS, Farzadfar F, Lozano R, et al. Prevention of cardiovascular disease in high-risk individuals in low-income and middle-income countries: health effects and costs. Lancet. 2007;(15)370:2054–62.
6. Stone NJ, Robinson JG, Lichtenstein AH, et al. 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2013 [E-pub ahead of print]; doi:10.1016/j.jacc.2013.11.002.
7. Pan American Health Organization. Taller para acelerar la implementación del manejo del riesgo cardiovascular en los servicios de salud. Pan American Health Organization; 2013. Available in Spanish from: http://www1.paho.org/hipertension/wp-content/uploads/2014/02/CardiovascularPublication.pdf Accessed on 22 October 2014.
8. Pan American Health Organization. Strategy and Plan of Action on *eHealth*. In: 51st Directing Council CD51/13. Washington, D.C.: PAHO, 2011. Available from: http://www.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=14572&Itemid= Accessed on 22 October 2014.
9. D'Agostino M, Al-Shorbaji N, Abbott P, Bernardo T, Ho K, Sinha C et al. eHealth initiatives to transform health in the Region of the Americas. Rev Panam Salud Publica 2014;35(5/6):326–8.
10. Organización Panamericana de la Salud. Conversaciones sobre eSalud: Gestión de información, diálogos e intercambio de conocimientos para acercarnos al acceso universal a la salud. Washington, D.C.: PAHO; 2014. Available from: http://bit.ly/conversaciones-pdf
11. Pan American Health Organization. PAHO eHealth Laboratory. Washington, D.C.: PAHO; 2015. Available at: http://www.paho.org/ict4health
12. Groupe Speciale Mobile Association. Mobile Economy Latin America 2013. Available from: http://gsma.com/newsroom/wp-content/uploads/2013/12/GSMA_ME_LatAm_Report_2013.pdf Accessed on 22 October 2014].
13. Pan American Health Organization. PAHO Cardiovascular Risk Calculator. Available from: http://www.paho.org/hq/index.php?option=com_content&view=article&id=10005&Itemid=41101.
14. Ordúñez García P, Campillo Artero C. Regional consultation: priorities for cardiovascular health in the Americas. Key messages for policy makers; Pan American Health Organization, 2010.

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Difusión de la evaluación del riesgo de enfermedad cardiovascular mediante la aplicación móvil de la OPS: una intervención de eSalud pública

RESUMEN

Las enfermedades cardiovasculares son la principal causa de muerte en la Región de las Américas. La evaluación del riesgo cardiovascular es un componente crítico del proceso de toma de decisiones clínicas y este proceso se facilita con la utilización de herramientas apropiadas.

Se presentan las características técnicas de una aplicación *(app)* para dispositivos móviles y computadoras producido por la Organización Panamericana de la Salud/Organización Mundial de la Salud, llamada Calculadora de Riesgo Cardiovascular, basada en las tablas de riesgo de la OMS y aplicada a los países de la Región. Se exponen los fundamentos epidemiológicos que subyacen al diagrama de predicción de riesgo cardiovascular, una descripción de la aplicación y de sus cuatro módulos, las audiencias primarias, su proceso de producción y, finalmente, los primeros resultados y algunos de los desafíos.

A los cuatro meses de su lanzamiento la aplicación estaba siendo utilizada diariamente por más de 12 000 usuarios y había sido descargada en prácticamente todos los países de la Región. La aplicación se puede utilizar en la práctica diaria de médicos, enfermeras y otro personal técnico, especialmente en el primer nivel de atención. Dado que también puede ser utilizada por el público en general, se prestó especial atención a su diseño y su tutorial, y a que las estimaciones y recomendaciones clínicas fueran fáciles de entender. Este tipo de aplicación facilita la comunicación entre los proveedores de atención sanitaria y los usuarios y es necesario promover su uso sistemático en los servicios de salud, en especial en los servicios de atención primaria.

Palabras clave Enfermedades cardiovasculares; atención primaria de salud; gestión de riesgos; difusión de innovaciones; evaluación de la tecnología biomédica; Américas.