

# Educational technologies designed to promote cardiovascular health in adults: integrative review

TECNOLOGIAS EDUCACIONAIS DESENVOLVIDAS PARA PROMOÇÃO DA SAÚDE CARDIOVASCULAR EM ADULTOS: REVISÃO INTEGRATIVA

TECNOLOGÍAS EDUCATIVAS DESARROLLADAS PARA LA PROMOCIÓN DE LA SALUD CARDIOVASCULAR EN ADULTOS: REVISIÓN INTEGRATIVA

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## ABSTRACT

**Objective:** Investigating the educational technologies developed for promoting cardiovascular health in adults. **Method:** Integrative review carried out in the databases of PubMed, SciELO and LILACS, with 15 articles selected. **Results:** Over half (60%) of the studies were randomized clinical trials. The developed educational technologies were programs involving three strategies, with duration of one year, use of playful technologies with storytelling, computer programs or software for smartphones, and electronic brochure. These technologies resulted in reduction of blood pressure, weight, waist circumference, decreased hospitalizations and increased years of life. **Conclusion:** The studies with better impact on the cardiovascular health of adults were those who brought the technology in the form of program and duration of one year.

## RESUMO

**Objetivo:** Investigar as tecnologias educacionais desenvolvidas para promoção da saúde cardiovascular em adultos. **Método:** Revisão integrativa realizada nas bases de dados PubMed, SciELO e LILACS, com a seleção de 15 artigos. **Resultados:** Mais da metade (60%) dos estudos foi de Ensaios Clínicos Randomizados. As tecnologias educacionais desenvolvidas foram programas envolvendo três estratégias e com a duração de um ano, além de tecnologias lúdicas com contação de histórias, programas de computador ou software para smartphones e folheto eletrônico. Essas tecnologias resultaram em redução dos níveis pressóricos, peso, circunferência abdominal, diminuição de internações e aumento dos anos de vida. **Conclusão:** Os estudos com melhores impactos na saúde cardiovascular dos adultos foram os que trouxeram a tecnologia em forma de programa e com a duração de um ano.

## RESUMEN

**Objetivo:** Investigar las tecnologías educativas desarrolladas para la promoción de la salud cardiovascular en adultos. **Método:** Revisión integrativa llevada a cabo en las bases de datos PubMed, SciELO e LILACS, mediante la selección de 15 artículos. **Resultados:** Más de la mitad (60%) de los estudios fue de Ensayos Clínicos Randomizados. Las tecnologías educativas desarrolladas fueron programas que abarcaban tres estrategias y con duración de un año, además de tecnologías lúdicas mediante el acto de contar historias, programas de computadora o software para smartphones y folleto electrónico. Dichas tecnologías resultaron en la reducción de los niveles presóricos, de peso y de la circunferencia abdominal, y también en la reducción de hospitalizaciones y aumento de los años de vida. **Conclusión:** Los estudios con mejores impactos en la salud cardiovascular de los adultos fueron los que proporcionaron la tecnología a modo de programa y con duración de un año.

## DESCRIPTORS

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## DESCRITORES

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## DESCRIPTORES

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## INTRODUCTION

Cardiovascular diseases (CVD) are the current leading cause of morbidity and mortality in Brazil and worldwide. Such diseases are responsible for 15.9 million deaths, affecting 35% of the population over 40 years. Its main risk factors result from lifestyle choices, particularly physical inactivity, high fat diet, smoking and alcohol consumption, in addition to overweight and obesity<sup>(1)</sup>.

In this context, disease prevention and health promotion have never been so urgent. The need to promote the health of the population and, consequently, decrease the morbidity and mortality from chronic diseases, including CVD, has led to reflections on the use of efficient strategies to promote health.

The technologies are strategies that can be used in the promotion of healthy behaviors, through the learning of skills for health care for facing the process of health-disease<sup>(2)</sup>.

Thus, the educational technology has excelled in providing education and health promotion for the population by allowing the systematic identification of the development, organization or use of educational resources, and management of these processes, as well as the use of techniques guided by equipment or support of visual resources in the educational setting.

Several studies have emphasized the role of technology in the prevention of CVD. The technologies stand out as resources of health promotion, in addition to the relationship between health professionals and the population, essential and decisive in the effectiveness of technology use. In this regard, the users should be considered as active agents in the actions of health promotion and disease prevention<sup>(3)</sup>.

This study aimed to investigate the educational technologies developed for promoting cardiovascular health in adults.

## METHOD

Based on the analysis of the material, organization and interpretation of the purpose of research was carried out an integrative literature review, aiming to summarize and evaluate the evidence to reveal the current knowledge about a topic<sup>(4)</sup>.

The present integrative review judiciously followed six steps: 1) selection of the guiding question; 2) definition of characteristics of the primary researches of the sample; 3) selection by peer review of the studies forming the sample of the review; 4) analysis of the findings of the articles included in the review; 5) interpretation of results; and 6) report of the review, providing a critical examination of the findings<sup>(4)</sup>.

The guiding question elaborated was the following: *What were the educational technologies developed for the promotion of cardiovascular health in adults, and their use in the context of the practice?* The construction of the question involved the PICO strategy (P-population: adults with cardiovascular disease, I-intervention / interest / independent variable: educational technology, C-comparator/dependent variable: health promotion; O-outcome: promoted health).

A paired search was carried out in the databases of LILACS, SciELO and PubMed, without temporal delimitation of the publications. The following descriptors were used: *technology, cardiovascular disease, health promotion*, according to the Health Science Descriptors (DeCS – Descritores em Ciências da Saúde) of the Virtual Health Library (BVS - Biblioteca Virtual em Saúde). For the systematization of searches, Boolean operators were used as follows: *technology and cardiovascular disease and health promotion*.

The inclusion criteria were studies on cardiovascular diseases in adults, of free access, available in full, and in Portuguese, English or Spanish. Review articles and guidelines were excluded.

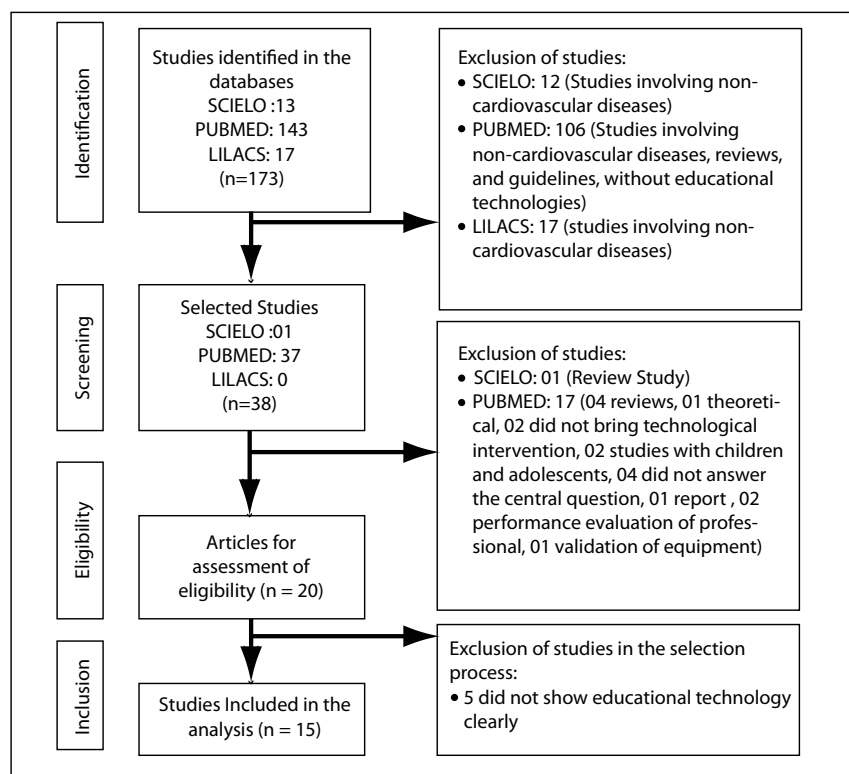
The articles were selected in the months of August and September/2013 by two researchers in different searches. In the PubMed database were used the descriptors *technology and cardiovascular disease and health promotion*. In total, 143 references were located, with 15 selected after the consent of two researchers.

In LILACS, no studies with the descriptors *technology and cardiovascular diseases and health promotion* were identified. After removing the descriptor *cardiovascular diseases*, 17 studies emerged, but none answered the research question nor fit the inclusion criteria. An article was found in SciELO, but it had to be excluded for being a review.

After this selection, there were 15 remaining articles, which comprised the research sample.

The PRISMA<sup>(5)</sup> (*Preferred Reporting Items for Systematic Review and Meta-Analyses*) was used in this study to explain the search and selection of studies, according to the following flowchart (Figure 1).

The next step was a critical and detailed analysis, making comparison with the theoretical knowledge, identifying findings and implications of educational technologies for the promotion of cardiovascular health. According to the recommendation of international literature specific for this type of study, the 15 articles selected for this review were used in results and discussion, seeking to integrate all their results and construct a general conception<sup>(4)</sup>. Thus, matrices of display data were developed to show the data encoded by the critical analysis<sup>(4)</sup>. Two matrices were generated for the presentation of results, the first with the characterization of studies and the second describing the type of technology used and its main results.



**Figure 1** – Flowchart of the selection of studies – Fortaleza, CE, Brazil, 2013.

## RESULTS

On the characterization of studies, the articles were diverse with regard to countries in which they were carried

out, the people and the methodological design. Chart 1 shows these characteristics.

**Chart 1** – Characterization of scientific literature on educational technologies for the promotion of cardiovascular health in adults Fortaleza CE, Brazil, 2013

COUNTRY	PLACE	METHOD	SAMPLE	DISEASE
Australia <sup>(6)</sup>	University research center	Randomized clinical trial	90 menopausal women aged 50-65 years	Prevention of CVD
USA <sup>(7)</sup>	Clinic	Randomized clinical trial	98 men and women	Type 2 diabetes
New Zealand <sup>(8)</sup>	Company (workplace)	Longitudinal with intervention group	39 healthy men and women	Prevention of chronic diseases, including CVD
Taiwan <sup>(9)</sup>	Hospital	Quasi-experimental study	141 elderly and non-elderly	CVD
USA <sup>(10)</sup>	Clinic	Randomized clinical trial	299 African-American men and women	Hypertension
USA <sup>(11)</sup>	Clinic	Randomized clinical trial	434 men and women	Hypertension
USA <sup>(12)</sup>	University	Methodological	15 sedentary people	Sedentary lifestyle
USA <sup>(13)</sup>	Health plan	Longitudinal with intervention group	534 members of health plans	Hypertension
Poland <sup>(14)</sup>	Research center	Quantitative and qualitative study	Quanti-934 Quali-30	Prevention of CVD
Italy <sup>(15)</sup>	Outpatient center	Randomized clinical trial	600 men and women	CVD, depression, anxiety, stress
Spain <sup>(16)</sup>	Health center	Randomized clinical trial	216 men and women aged 18-65 years	Prevention of CVD
USA <sup>(17)</sup>	---	Intervention protocol	African-American veterans	Hypertension
Australia <sup>(18)</sup>	Hospital	Qualitative study with focus group	35 men and women with BMI 27 to 38 Kg/m <sup>2</sup>	CVD
Taiwan <sup>(19)</sup>	Health center	Quasi-experimental study	323 farmers/fishermen	Type 2 diabetes
Canada <sup>(20)</sup>	Community	Randomized clinical trial	140 thousand elderly (over 65 years old)	CVD

Based on Chart 1, it was possible to observe the diversity of publications in relation to the country of origin. Almost half of the studies (40%) was carried out in the United States of America (USA). In relation to the methodological design, the studies show high impact drawings, because more than half (60%) was of randomized clinical trials and quasi-experimental studies in search of effective technologies for the prevention of cardiovascular events. Regarding the sample size, were observed studies that had samples consistent with the research designs, ranging from 15 to 140,000 participants.

Experimental and quasi-experimental studies have greater potential than observational studies in what concerns the implementation of strategies to change behavior and positive attitudes in the lives of people.

In this perspective, the use of research designs with rigorous methods, which allow greater control of the studied variables, has promoted reliable results, with better response for actions of prevention and control of chronic diseases, including cardiovascular diseases, thus reducing rates of morbidity and mortality in the diverse populations.

Chart 2 presents the educational technologies used in promoting cardiovascular health

**Chart 2** – Educational technologies and its results – Fortaleza, CE, Brazil, 2013

TECHNOLOGY	MAIN RESULTS
Program of women's well-being <sup>(6)</sup>	Increase in aerobic exercise and decreased smoking, waist circumference, BMI and blood pressure.
Electronic brochure <sup>(7)</sup>	It enabled interaction and increased the proportion of adherence to statins.
Labor program with healthy eating and physical activity <sup>(8)</sup>	Reduction of lipid profile in 12 weeks and the maintaining of cholesterol levels in a year.
Telehealth service <sup>(9)</sup>	Decrease in admission rates and average hospital stay from all causes.
Culturally appropriate storytelling by recording of interviews on DVD <sup>(10)</sup>	Reduction of 11 mmHg in systolic pressure. People over 65 years had advantages over younger in lowering of blood pressure.
Computer program, video documentary and narrative <sup>(11)</sup>	Patients who received the intervention did not differ from participants in the control group (51% VS 49%).
Smartphone apps for promoting physical activity <sup>(12)</sup>	Desirable features of the app: automatic location of loads measures and burned calories, graphs, tables and statistics of physical activity performance.
Educational kit: DVD on blood pressure, nutritional guide, brochure 'walking' and sphygmomanometer <sup>(13)</sup>	45% of people controlled the blood pressure in six months. In a year, in all participants, 0.3 events were avoided and 2.77 years of life gained.
Mass media (TV, press, radio, flyers, pamphlets, posters, and internet) <sup>(14)</sup>	96% had information of at least one health behavior; 86% rated positively the idea of promoting a healthy lifestyle in the media.
Application of well-being therapy (WBT) using mobile technology <sup>(15)</sup>	It enabled testing the effectiveness of WBT with and without mobile technology.
Health Workshops <sup>(16)</sup>	Offering a different approach to health promotion with emphasis on self-care.
Interventions with storytelling (DVD) <sup>(17)</sup>	Improving the self-management in hypertension control by African-American veterans.
Healthy Eating, Exercise and Lifestyle Program (HEELP) <sup>(18)</sup>	Difficulties in incorporating measures for weight reduction. Group of strategies for weight reduction, such as the creation of basic principles and establishment of routines.
Program of health promotion <sup>(19)</sup>	After six months: improvement in weight, waist circumference, glucose, cholesterol, diastolic blood pressure and self-care with feet.
Knowledge program of cardiovascular health <sup>(20)</sup>	Reduced costs of hospitalizations for cardiovascular diseases.

Based on Chart 2 it was possible to observe the diversity of educational technologies developed for promoting cardiovascular health in adults. Education services of broad reach as telehealth, workshops and mass media are some of the technologies used. Chart 2 also shows technologies involving playful forms, with interventions through storytelling. The use of programs for reducing cardiovascular risk, as well as technologies that use software to promote cardiovascular health were also found in this study.

control and treatment of chronic diseases, whether communicable or non-communicable. In non-communicable chronic diseases, these technologies have provided the transmission of knowledge for the population, the exchange of experiences and the search for new forms of care.

The diversity of technologies and their use in the context of health have provided paradigm shifts in the prevention,

The new educational technologies have allowed the encounter with the other in a sense of jointly discussing actions for health promotion, particularly of cardiovascular health, because of the urgent need to reduce the high rates of cardiovascular diseases in the global context.

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## DISCUSSION

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The telehealth service was used in a group of inpatients with hypertension admitted to a hospital in Taiwan. The intervention included assessment of health, education, health promotion and individualized counseling by phone and evaluation over a period of one year to 387 people with diabetes. The use of this technology resulted in decrease in admission rates and average hospital stay from all causes in the elderly and non-elderly. In addition, there was an increase of ambulatory visits for all causes in both elderly and non-elderly, but the telehealth service had no influence on visits to emergency services<sup>(9)</sup>.

It is noteworthy that telehealth services must be defined considering three components, namely: the real time transmission of biometric data between healthcare professionals and patients; the availability of telephones for communication and health promotion, as well as the existence of a specialized health team for exchanging information 24 hours<sup>(9)</sup>. This service can be delineated by the nurses who perform care by the tracing and careful examination of clinical information, contacting patients at least once a day.

In a Research Center in Poland, a study investigated the public opinion about promoting a healthy lifestyle in mass media (television, press, radio, flyers, pamphlets, posters and internet)<sup>(14)</sup>. The results showed that 96% of the respondents received information from at least one health behavior. The television was the most widely used medium (95%) and the internet (37.9%) the less used. Most Polish people are characterized by having positive attitudes toward the promotion of a healthy lifestyle. Among the total, 71.4% showed positive attitudes, while 13.7% had definitely positive attitudes, and 86% positively assessed the idea of promoting a healthy lifestyle in the media. The results of the multivariate linear regression allowed analyzing the predictors in the direction of promoting a healthy lifestyle in the media, which is related to sociodemographic characteristics such as gender, level of education, occupational category and marital status<sup>(14)</sup>.

Such studies are relevant to health systems, since the communication through mass media reaches a significant portion of the population and helps in the dissemination of information to promote health, providing subsidies for building marketing and advertising aimed at favoring the health level of people.

Some studies showed educational technologies in longitudinal programs with an average duration of one year<sup>(8,16,18-19)</sup>. A study carried out in a health center in Spain<sup>(16)</sup> used health workshops as one of these technologies. These are group interventions, in which the activities of life were approached progressively over a year. The sections were intended to increase knowledge and develop skills and motivations that helped in the activities of life and progressive incorporation of healthy habits. In order to

ensure the unification of the passed message, slides were prepared and delivered at the end of each session. This study did not bring the results of a concrete intervention however, according to the authors, the workshop consisted in an innovative approach to health promotion, emphasizing the self-responsibility of every individual with his/her own health<sup>(16)</sup>. A similar study was carried out in the USA<sup>(13)</sup> and in a community in Canada<sup>(20)</sup>.

An educational intervention program was developed with hypertensive people, participants of an American health care plan. They received an educational kit containing a DVD with basic information about blood pressure, a basic nutritional guide in booklet that taught about the walking program, and an automatic sphygmomanometer. The results of this intervention were promising in all 534 participants, who were followed for one year, noting that 0.3% events were avoided and 2.77 life years were gained<sup>(12)</sup>. The Canadian study developed the Knowledge program of cardiovascular health, which involved the identification and management of risk factors for cerebrovascular accident - stroke, and heart disease, with the coordination by health professionals and community. This program was associated with reduced costs of hospitalizations for CVD, but without differences in the rate of use nor in costs for all hospitalizations<sup>(20)</sup>.

The Healthy Eating, Exercise and Lifestyle Program (HEELP) was developed in a hospital in Australia. Participants were monitored and instructed about lifestyle changes, including physical exercise and healthy eating. During the program, participants reported difficulties in incorporating measures for weight reduction. However, they mentioned many strategies to achieve it, such as creating basic principles, establishing routines for regular practice of physical exercise, controlling food portions and reducing the amount of calories, using fresh food rather than processed foods, nutritional ingredients and simple seasoning<sup>(18)</sup>.

A study carried out in New Zealand<sup>(8)</sup>, described an educational program developed and implemented with healthy men and women in the workplace. The study included healthy eating (consumption of kiwi), physical activity and guidance on the consumption of whole grains, fruits, vegetables and fish oil<sup>(8)</sup>. There was a reduction in lipid profile, i.e., of total plasma cholesterol in 12 weeks and the maintaining of cholesterol levels in a year. The intervention also significantly reduced plasma levels of glucose and insulin. However, changes in plasma biochemistry were not accompanied by changes in weight and waist circumference. Changes in physical activity and diet significantly increased the plasma antioxidant activity during the 12 weeks, and potentially decreased the level of oxidative damage. The kiwi consumption showed no significant effects on blood biochemistry, however, the daily consumption of two or three fruits showed increase in plasma antioxidant activity<sup>(8)</sup>.



An educational program was developed in a health center in the United States to intervene with men and women, farmers and fishermen in rural areas with Type 2 diabetes<sup>(9)</sup>. It was a multistage program of health promotion that considered the cultural dimension of the subjects and was developed by a multidisciplinary team. After six months of the intervention program, there was statistically significant improvement in several physiological indicators (body weight, waist circumference, fasting plasma glucose, total cholesterol and fractions, diastolic pressure and self-care with the feet). There were no significant changes in systolic blood pressure and triglycerides. A similar activity was developed with women in a Center of academic research in Australia<sup>(6)</sup>.

The study consisted in the Program of women's well-being, divided into three parts: the first part was a personal diary divided into 12 weeks and designed to offer women the daily or weekly focus in each step of the program; the second part consisted of a weekly exercise planning; and the third part was the daily record of diet and exercising, encouraging the registration of follow-up of measurements in the personal diary of women. The program included consultations with nurses, in which there were activities of health education, sessions of goal setting, checking of anthropometric measurements such as weight, height, waist and hip circumference, as well as blood pressure and heart rate. The results of the program proved to be effective in increasing weekly aerobic exercising and decreasing smoking, besides significantly reducing waist circumference, BMI, blood pressure and weight<sup>(6)</sup>.

The use of effective strategies based on the involvement of the population has greater and better responses in the prevention and reduction of cardiovascular risk factors. These strategies are seen as fundamental to combat the generalization and growth of epidemics such as obesity, hypertension, diabetes and other cardiovascular diseases, since they can provide more awareness of people in the search for actions of prevention and treatment of chronic diseases<sup>(21)</sup>.

Some studies have addressed the use of educational technologies that involve playful strategies with participants<sup>(10,17)</sup>. Culturally appropriate storytelling for people with high blood pressure by recording the interviews on DVD was a technology applied to African-Americans with controlled and uncontrolled clinical hypertension in the USA. The results of this intervention showed significant changes in the intervention group. People over 65 years showed advantages over younger ones with regard to blood pressure reduction, although not significant. People with uncontrolled hypertension, who were in the intervention group showed a reduction of 11 mmHg in systolic pressure. There were also significant changes in diastolic pressure. The intervention with technology did not increase the maintaining of control among people with controlled hypertension<sup>(10)</sup>. Similar intervention was carried out

in the USA, with hypertensive African-American adults through real life storytelling, created with the incorporation of theater lessons, and using together science-based theoretical contents, which can improve hypertension self-control<sup>(17)</sup>.

In order to obtain a significant learning, it is necessary to use the resources offered by educational technologies that emphasize the content to be learned and the possibility of using new strategies of more exciting teaching, such as the playful approach, which allows other meanings in the involvement of the care process.

Some studies involved using equipment or software for promoting cardiovascular health<sup>(7,12,15)</sup>. In Italy, patients of a heart disease ambulatory received the intervention of application of the Well-being therapy (WBT) using personalized mobile technology to reduce the psychological stress, from a randomized clinical trial. The use of WBT based on a customized mobile technology can allow testing the effectiveness of this technology in promoting a healthy lifestyle in people with cardiovascular diseases, compared with the usual WBT<sup>(15)</sup>.

On the other hand, a group of adults of both sexes with type 2 diabetes mellitus treated at a clinic in the USA received an electronic brochure as educational intervention<sup>(7)</sup>. The electronic brochure was applied from a session of conversation between doctors and patients to help in their decision about using statins or not for the prevention of CVD risk. The conversation between them with use of the technological tool to help in the decision (electronic brochure) allowed exchanging information on the use or nonuse of statins in the prevention of cardiovascular disease risks, enabled the interaction, reduced uncertainty of patients, and increased the proportion of adherence to use of statins in three months<sup>(7)</sup>.

Smartphone apps for physical activity promotion was another educational technology applied in a University. The study investigated what would be the best features for the development of this application. The listed features of the smartphone application for promoting physical activity (PA) were the following: automatic location of loads measurements and burned calories, resource of daily photos to view the progress of localization, general graphs, tables, statistical performance of the PA, integrated feature for listening to music during PA, metronome, location of the history of PA, progress towards PA and weight goals, calculator of body mass index-BMI, and feature of setting goals. The study incorporates evidence-based components and user preferences for developing the educational technology<sup>(12)</sup>.

A study used a computer software to improve the adherence to antihypertensive medications of Americans living in rural areas. The intervention involved a computer program (cyber nurse), a video (video documentary) and a bookstore with models of narratives. Both interventions

were done at home, and delivered via computer by the community health advisor. Promoting adherence was focused on related theoretical variables (eg, barriers and decision balance). Patients who received the intervention did not differ from subjects in the control group (51% vs 49% adherent, respectively,  $p = 0.67$ ). However, other variables could be perceived, such as forgetting to take medications ( $p = 0.01$ ) and difficulty in reaching the clinic to get medication ( $p < 0.001$ )<sup>(11)</sup>.

Based on the foregoing, it was found that longitudinal studies with interventions lasting less than one year and a single action did not show the acquisition of satisfactory health outcomes. The most effective studies were those with more than one intervention and duration of more than one year.

Among the educational technologies, the development and application of software for cardiovascular health promotion developed by nurses stand out. The construction of these technologies should consider essential elements such as the support of theoretical background, implementation guidelines that include the record of data generated during the use of software, for further analysis and comparison of results, and ease of use. These elements are consistent with the best responses obtained with the continuous application of this technology.

Therefore, it is essential to use educational technologies developed from the context of health services and community, aimed at promoting cardiovascular health and that allow the development of critical consciousness for acquiring healthy habits.

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## CONCLUSION

The survey found that several educational technologies are used in promoting cardiovascular health, involving various strategies to reduce morbidity and mortality from cardiovascular diseases. It is noteworthy that studies with better impact on the cardiovascular health of the participants were those who brought the technology in the form of a program. The studies with designs of a single technology did not have a good impact on cardiovascular health, compared to those with designs of multiple technologies. Furthermore, it was shown that studies of this type require longitudinal design as a form of long-term observation of the impact of these technologies on everyday life.

The limitations of the present study are that some analyzed studies did not bring a detailed description of each technology, which hindered further investigation of the relationship of technology use with the many variables used in the primary studies and their impact on outcomes.

There is a need for more studies on technologies for health promotion and prevention of CVD, particularly in the Brazilian reality, since such studies were not found in the national scientific literature, showing a knowledge gap. It is emphasized that future studies of longitudinal design, duration of more than one year and using more than one technology, with focus on prevention of CVD should be carried out. These findings demonstrate that the development and use of these educational technologies can be effective in preventing and reducing morbidity and mortality due to CVD in our population.

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