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CONTENT VALIDATION: SAFE HEART MOBILE APPLICATION FOR MONITORING AND IDENTIFICATION OF INFARCTION RISK

VALIDAÇÃO DE CONTEÚDO: APLICATIVO MÓVEL *SAFE HEART* PARA MONITORAMENTO E IDENTIFICAÇÃO DE RISCO DE INFARTO

VALIDACIÓN DE CONTENIDO: APLICACIÓN MÓVIL *SAFE HEART* PARA EL SEGUIMIENTO E IDENTIFICACIÓN DEL RIESGO DE INFARTO

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Objective: to verify the content validity of the Safe Heart mobile app for monitoring and identification of infarction risk. Method: content validation study. Ten judges participated in the study. Twenty-one items were evaluated using the Likert scale. To estimate the degree of agreement, Cronbach's alpha coefficient was calculated. Results: Cronbach's alpha statistical analysis with 0.9573 consolidated Safe Heart regarding validity and reliability in the internal consistency of the content developed in the application; the judges presented valid consistency in the observed items. Conclusion: the content validity of the Safe Heart mobile app has been approved for monitoring and identification of infarction risk.

Descriptors: Information Technology. Validation Studies. Health Technology.

Objetivo: verificar a validade de conteúdo do aplicativo móvel Safe Heart para monitoramento e identificação de risco de infarto. Método: estudo de validação de conteúdo. Participaram do estudo 10 juízes. Foram avaliados 21 itens, por meio da escala de Likert. Para estimativa do grau de concordância, foi utilizado o cálculo do coeficiente alfa de Cronbach. Resultados: a análise estatística com alpha de Cronbach 0,9573 consolidou o Safe Heart quanto à validade e à confiabilidade na consistência interna do conteúdo desenvolvido no aplicativo; os juízes apresentaram

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consistência válida nos itens observados. Conclusão: a validade de conteúdo do aplicativo móvel Safe Heart foi aprovada para monitoramento e identificação de risco de infarto.

Descritores: Tecnologia da Informação. Estudos de Validação. Tecnologia em Saúde.

Objetivo: verificar la validez de contenido de la aplicación móvil Safe Heart para el seguimiento e identificación del riesgo de infarto. Método: estudio de validación de contenido. Diez jueces participaron en el estudio. Veintiún ítems fueron evaluados mediante la escala Likert. Para estimar el grado de concordancia, se calculó el coeficiente alfa de Cronbach. Resultados: el análisis estadístico con Cronbach de alfa 0,9573 consolidó Safe Heart en cuanto a validez y confiabilidad en la consistencia interna del contenido desarrollado en la aplicación; los jueces presentaron consistencia válida en los ítems observados. Conclusión: la validez de contenido de la aplicación móvil Safe Heart ha sido aprobada para el seguimiento e identificación del riesgo de infarto.

Descriptores: Tecnologías de la Información. Estudios de Validación. Tecnología en Salud.

Introduction

The term "technology" is formed by the Greek radicals *tekhne*, which means "technique, art, craft", and *logos*, which refers to "set of knowledge". Technology is a constant object of study of science and engineering. With technological advances, people have the possibility of contact with computer systems, which allows the improvement of processes in various areas of knowledge and new possibilities and challenges for interactions between people and machines[1-2].

Among the diversity of technologies, predictive stands out, which combines a series of mathematical and statistical techniques and formulas, such as machine learning and data mining, to collect real-time data and then point out trends, identify risks and make predictions[3].

In the health area, predictive models allow identifying existing patterns, including demographic and behavioral variables of patients. These resulting models identify, in addition to segments of a population of possible high-cost possible patients, the factors that lead patients to have a high cost profile. Through predictive analysis models, it is still possible to make predictions of hospitalization rates, probability of infections and diseases, as well as predict potential patients for health and wellness programs. Its results, when combined with public health measures applied at the population level, can have positive implications for cost reduction and effectiveness of interventions, such as treatments and preventive actions[3-4].

Related to this technological advance in health, there is growing use of mobile technology in society, influencing the search for information and interactivity with users. Mobile devices, such as smartphones, tablets, notebooks have been used in several contexts to boost the flow of information data, contributing to the production of knowledge in networks and the expansion of communication in health services[2].

The popularization of smartphones has been considered a technological revolution of greater impact, with high growth of devices in the market. With this, mobile phone applications are increasingly part of people's routine, as they can be used for various purposes, such as: calling a private car, ordering a meal, downloading music and watching videos. Over 300 billion applications are downloaded per year by proactivity, diversity and easy access[5].

Mobile health apps aim to assist the users' health care. In order to cover concepts related to the use of technological means applied in health care, the World Health Organization (WHO) defined the terms *eHelth* and *mHealth*. Thus, mobile applications have become important support tools in patient care, as they enable care procedures, in addition to providing access to information quickly and safely, solving problems and optimizing activities performed on a daily life[6].

Linked to mobile applications, technologies considered wearable have also stood out in the technology market, such as smartwatches. Smartwaches are widely used to assist in monitoring, verification and notification care for the user. When integrated with mobile applications, the functionality of the system expands, allowing greater reliability and aid in the user's health[7-8].

In this sense, a team of nurses designed, projected and developed a mobile application for monitoring and identifying the risk of infarction. It is a mobile application integrated to the smartwatch called SAFE HEART developed by the team of the Laboratory of Technology in Health and Education (LABTECS) of the Universidade do Estado do Amazonas (UEA) for the Android system, funded by Law n. 8.387/1991[9]. LABTECS, a research group accredited by the research directory of the Coordination for the Improvement of Higher Education Personnel (CAPES), is composed of a team of PhD nurses and researchers in the area of health technology. Labtecs' infrastructure consists of an area of 106.60 m^2, divided into five environments for the execution of projects focused on health and technology.

The product was developed in 2019 by a team of four nurses, a computer technologist, a design, three mobile app developers and two testers. To use it, the user must download the app from the Play Store, install the app on their Android system smartphone, and sync with the smartwatch.

SAFE HEART is integrated with the smartwatch that monitors heart rate, analyzing frequency and rhythm. It helps the individual to identify changes related to heart rate and rhythm, factors related to cardiovascular diseases that may compromise the user's life. Integration with the smartwatch is necessary, so that cardiac parameters are evaluated frequently while the individual is making use. Thus, when a change in the pattern of heart rate and rhythm is identified, an alert is issued so that the user can avoid complications in his/her health.

The SAFE HEART app analyzes parameters during sleep, rest, and physical activities to identify the user's pattern. Its use can prevent death from cardiovascular diseases, because it emits alert in a timely manner, so that medical care can be sought. It also has some functionalities, such as: identifying the user's risk factors by reading the answers to a risk questionnaire; establishing the degree of risk of infarction, whether low, medium or high; recording a variance of the heart rate, issuing alerts of changes and function of geolocation, in case of high risk of infarction in the user.

In this way, the SAFE HEART app directly impacts the user and family by issuing alerts that anticipate adverse events that can culminate in death. Upon receiving the alert notification, the user can anticipate and require immediate help, triggering the local health system.

The purpose of this article is to verify the content validity of the SAFE HEART mobile app integrated with smartwatch for monitoring and identification of infarction risk.

Method

Content validation research of the SAFE HEART mobile app integrated with the smartwatch to identify the risk of acute myocardial infarction. The validation process consists of a useful judgment for decision making, providing the researcher with assurance of effective choices for the production and success of a product. It aims to evaluate the quality of a product and its components and is performed by specialists in the area that one wants to evaluate[10].

Ten specialist nurses from a public institution in Manaus (AM) participated as judges of this study. The selection of the sample composed by convenience was performed by the model known as snowball, a form of non-probabilistic selection.

There is no pre-established number for the choice of judges to validate the results obtained. This number may vary according to the phenomenon studied and the criteria for selection. Thus, the inclusion criterion, in the case of this research, following the recommendation of similar studies[11-12], was the nurse reaching a minimum of three and the maximum of ten

points, according to the following conditions: PhD in nursing (4 points); MSc professor in education or nursing (3 points) and development of technologies in health or education (2 points); nursing professor (1 point).

The active search for nurses with health and technology expertise was performed at the Lattes Platform. Ten judges were thus invited through the digital invitation letter. After acceptance, the Informed Consent Form (ICF) was sent, as determined by Resolution n. 466/2012[13], which, after signing, confirmed participation in the study.

Data collection, in view of the risks of transmission of the new coronavirus, occurred at LABTECS facilities in March 2021, following all the recommendations contained in the health care plan in the conduct of research. The judges used the mobile app integrated into the smartwatch in a test environment, with the app installed on a Samsung Galaxy S10 smartphone and a Samsung Galaxy Watch 2 smartwatch. The time of the evaluations lasted an average of 30 minutes.

The data collection instruments were a SAFE HEART mobile application integrated with smartwacth and two forms: one of sociodemographic data, for characterization of judges; and another for evaluating the content of the SAFE HEART mobile app. The latter was constructed by adapting a validated questionnaire, based on ISO/IEC 12207 and ISO/DIS 9241-11[14]. In the answers, the Likert scale from 1 to 4 points was used, which considered the following scores: (1) irrelevant; (2) not very relevant; (3) relevant; (4) very relevant.

The data analysis related to the characterization and evaluation of the judges was organized in a spreadsheet of the Microsoft Excel Program. The data were presented in the form of relative and absolute frequencies.

For content validation, each item of the evaluation instrument was scored on a Likert scale. Next, to estimate the degree of agreement among the judges and to provide evidence of the accuracy and reliability of the score test, Cronbach's alpha coefficient was used to calculate the Cronbach's alpha coefficient in the observation of internal agreement for validation. Thus, the lower the variance, the more consistent the evaluated content is. If the Cronbach's alpha coefficient value is low, the mean correlation between the evaluated items is also. Therefore, the minimum acceptable value for alpha is 0.70; below this value, the internal consistency of the scale used is considered low[15-16].

Regarding the ethical considerations of the research, this study is part of the macroproject entitled "Development and Validation of Interactive Technologies in Health and Education in The Innovation of Human Care" of LABTECS. Following Resolution N. 466/2012[13], of the National Health Council, it was sent to the Research Ethics Committee of the State University of Amazonas, which approved it by Opinion n. 3.574.288 and Certificate of Presentation of Ethical Appreciation (CAEE) 15924919.6.0000.5016.

Results

Among the judges who agreed to participate in the study, nine were female and one were male. The mean age was 41 years, corresponding to an age group between 27 and 57 years. As for academic education, all graduated in Nursing, with an average graduation time of 14.9 years, being the most experienced graduated in 2003 and the youngest, graduated in 2018. All judges had lato sensu postgraduate studies in the most varied specialties: one in Occupational Nursing, two in Health Management, two in Urgency and Emergency, one in Mental Health, one in Surgical Nursing, one in Hospital Administration, one in Hemotherapy and one in High Complexity Nursing. Still on the training, four judges were PhD, two MSc and four specialists.

Regarding the professional performance of the judges, four worked exclusively in care and six in higher education. Nine of them participated or would have participated in research in the area of technology and health.

According to the inclusion criteria, the judges should reach a minimum of three and a maximum of ten points in the items: for nurses

- PhD in nursing (4 points), MSc professors in nursing education (3 points), development of technologies in nursing education (2 points), nursing teacher (1 point). Table 1 shows the score achieved by the judges, according to this criterion.

Table 1 – Score achieved by specialist judges. Manaus, Amazonas - Brazil – 2021. (N=10)

Specialist judges	n	Score	%
Nurses			
PhD	10	4	40.00
Specialist	6	4	40.00
MSc	3	2	20.00
Total	10	. .	100.00
Mean	. .	7.0	. .

Source: Created by the authors.

Note: Conventional signal used:
. . Numeric Data does not apply.

Regarding the score achieved by the judges, an average of 7.0 points was obtained, in which the minimum was four and the maximum was seven points. It is observed that 80% of the judges scored above mean and only 20% obtained the minimum score required.

As for the content validity of the SAFE HEART mobile application, Cronbach's alpha coefficient was used for observation of internal agreement for validation. Twenty-one items related to the application were evaluated. The assessment of the degree of agreement was calculated based on the proportion of assertions that reached the scores (3) Relevant and (4) Very Relevant.

Table 2 shows the results of Cronbach's alpha coefficient of 0.9573, considering one of the estimators of internal consistency. This means that the questions answered by the judges presented valid consistency in the observed items.

Table 2 – Content validation of the SAFE HEART mobile application. Manaus, Amazonas, Brazil – 2021

(continued)

Evaluated items		Cronbach Alpha
1.	Will SAFE HEART be useful in your work?	0.9645
2.	I am satisfied using this SAFE HEART app	0.9634
3.	When you know the application of the SAFE HEART app, I think it will help save time to develop my activities	0.9605
4.	I intend to use the app SAFE HEART in my professional practice	0.9598
5.	It was simple to use SAFE HEART app, And I understood the questions for him directed	0.9587
6.	I was able to perform my activities using the SAFE HEART app	0.9573
7.	App SAFE HEART does not replace my actions; it helps me decide the best way for decision making	0.9554
8.	I felt comfortable using the SAFE HEART app	0.9546
9.	It was easy to learn how to use the SAFE HEART app	0.9537
10.	I believe I could become quickly more productive using the app SAFE HEART	0.9525
11.	App SAFE HEART provides clear error messages, reporting how to correct any mistaken problem or decision	0.9516
12.	If I make a mistake with the SAFE HEART app, I can easily and quickly recover my data already stored	0.9512
13.	The information provided by App SAFE HEART (Messages, Questions, Options and other documents) are clear	0.9507
14.	It is easy to navigate the SAFE HEART app to find the information I need	0.9505

Table 2 – Content validation of the SAFE HEART mobile application. Manaus, Amazonas, Brazil – 2021 (conclusion)

Evaluated items		Cronbach Alpha
15.	Information from App SAFE HEART is properly organized and contemplates my daily rating	0.9504
16.	The App SAFE HEART interface is nice (colors, Picture, Items arrangement, Navigation etc.)	0.9504
17.	I enjoyed using the App SAFE HEART interface	0.9507
18.	App SAFE HEART has all the functions I expected	0.9514
19.	Above all, I am satisfied with the SAFE HEART app	0.9520
20.	It is simple and easy to use the SAFE HEART app	0.9525
21.	The organization and disposal of information on the SAFE HEART App screens are clear and objective	0.9512
	Total	**0.9573**

Source: Created by the authors.

The results showed that the items evaluated are homogeneous and measure, consistently, the characteristics of the evaluated mobile application. Therefore, they are reliable and prove the validity of content.

Discussion

Mobile apps have been highlighted in healthcare, with an immense variety of app options ranging from fitness systems to disease monitoring and control. However, the development of a mobile application for health requires coherence and adequacy, in addition to recognizing the user's need. Therefore, the validation of a developed application is important to verify specific health-related demands[17].

To this, it is essential to form a committee of expert judges. Moreover, the researcher needs to determine the criteria according to the objectives of the study. However, regardless of what is desired to be validated, and even if the researcher uses his/her own or adapted criteria, it is essential to establish and respect the necessary requirements to consider an expert nurse[18].

In validation studies, the selection of expert judges is essential to promote the accuracy of application content, because inadequate choice can influence the reliability of the results[11]. According to the inclusion criteria, in this survey, 40% of the specialists achieved the maximum score. In addition, the analysis of the Lattes curriculum allowed nurses with content expertise to be evaluated.

In Brazil, the Lattes Platform integrates the databases of curricula, research groups and institutions into a single information system. The search on this platform allows selecting highly qualified specialists[19]. In this research, the sampling of snowball judges and the analysis of the Lattes curriculum were steps that ensured favorable selection for validation success. On the other hand, the number of selected expert judges is consistent with the one pointed out in the literature, which recommends a minimum of five to six participants[19]. The study was conducted with ten nurses, and this ensured the diversity of information and robustness of the results.

In this study, the forms with 21 items to evaluate the content of the SAFE HEART mobile application were sent digitally. The results showed desirable internal consistency and showed homogeneity in the items evaluated, resulting in the validity of application content. In order for the evaluated items to present satisfactory internal consistency, they should have Cronbach's alpha greater than 0.7[15]. In this sense, it is possible to affirm that the reliability of the SAFE HEART mobile application is adequate, since it presented Cronbach's alpha 0.9573.

In this way, the SAFE HEART mobile app has quality of content and contributes to the decision-making of the user at risk of heart attack. It is useful for accessing, collecting information,

monitoring heart rate, identifying the degree of risk of heart attack, and issuing notifications to the user.

As future perspectives, it is intended to improve and aggregate other functionalities in the application, to improve the monitoring of the user's health.

The study has limitations regarding the open use of the SAFE HEART mobile app, as it continues in testing, with the insertion of new features, and can only be used in specific test environments.

It is expected, with this research, to arouse the interest of other nurses, for the development of new technologies that align the theoretical-practical knowledge of nursing, seeking to improve the quality of health of technology users.

Conclusion

The SAFE HEART content validation study allowed concluding that the mobile application was approved. Cronbach's alpha statistical analysis 0.9573 consolidated SAFE HEART regarding validity and reliability in the internal consistency of the content developed in the application.

Collaborations:

1 – conception, design, analysis and interpretation of data: Maria Luiza Carvalho de Oliveira, Eveline Menezes Caçote Barbosa and Elielza Guerreiro Menezes;

2 – writing of the article and relevant critical review of the intellectual content: Mineia Rossete de Souza, Gladson Souza de Araújo, Suelem Maciel do Nascimento and Daniely Bianca Magalhaes de Figueiredo Carvalho;

3 – final approval of the version to be published: Maria Luiza Carvalho de Oliveira.

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