

# Evaluation of the usability of the Quali+ mobile application for people with high blood pressure



*Avaliação da usabilidade do aplicativo móvel Quali+ para pessoas com hipertensão arterial*

*Evaluación de la usabilidad de la aplicación móvil Quali+ para personas con hipertensión arterial*

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## ABSTRACT

**Objective:** To evaluate the usability of the “Quali+” mobile application prototype for people with high blood pressure.

**Method:** Descriptive, cross-sectional study of heuristic evaluation of a mobile application prototype carried out between June and July 2021, in a university hospital. Participants were 22 people with arterial hypertension in the city of Campina Grande, PB, Brazil. To measure usability, the Smartphone Usability questionnaire instrument was applied. Levels  $\geq 70$  points have good usability. Descriptive statistics were used.

**Results:** The overall usability average was  $105.8 \pm 7.44$  points, with the lowest score being 83 and the highest being 113. Usability was at the highest level (80 points).

**Conclusion:** The usability evaluation showed that, although it is a prototype, the application has good usability and can be considered for routine use in health self-management. Future research is needed to verify its effectiveness.

**Descriptors:** Mobile applications. Hypertension. Self care. User-centered design. Technology. Nursing.

## RESUMO

**Objetivo:** Avaliar a usabilidade do protótipo de aplicativo móvel “Quali+” para pessoas com hipertensão arterial.

**Método:** Estudo descritivo, transversal, de avaliação heurística de um protótipo de aplicativo móvel realizado entre junho e julho de 2021, em hospital universitário. Participaram 22 pessoas com hipertensão arterial, na cidade de Campina Grande, PB, Brasil. Para mensuração da usabilidade, aplicou-se o instrumento Smartphone Usability questionnaire. Níveis  $\geq 70$  pontos apresentam boa usabilidade. Utilizou-se da estatística descritiva.

**Resultados:** A média geral de usabilidade foi  $105,8 \pm 7,44$  pontos, obtiveram-se como menor escore 83 e, maior 113. A usabilidade se enquadrou no nível mais elevado (80 pontos).

**Conclusão:** A avaliação da usabilidade constatou que, ainda que se trate de um protótipo, o aplicativo apresenta boa usabilidade, podendo ser considerado para o uso rotineiro na autogestão em saúde. Pesquisas futuras são necessárias para verificar a eficácia.

**Descritores:** Aplicativos móveis. Hipertensão. Autocuidado. Design centrado no usuário. Tecnologia. Enfermagem.

## RESUMEN

**Objetivo:** Evaluar la usabilidad del prototipo de aplicación móvil “Quali+” para personas con hipertensión arterial.

**Método:** Estudio descriptivo, transversal, de evaluación heurística de un prototipo de aplicación móvil realizado entre junio y julio de 2021, en un hospital universitario. Los participantes fueron 22 personas con hipertensión arterial en la ciudad de Campina Grande, PB, Brasil. Para medir la usabilidad se aplicó el instrumento Smartphone Usability Questionnaire. Los niveles  $\geq 70$  puntos tienen buena usabilidad. Se utilizó estadística descriptiva.

**Resultados:** Los principales hallazgos del estudio deben presentarse de manera concisa y clara, sin excesivos detalles. Los resultados deben estar alineados con la sección de resultados del artículo completo, proporcionando información más detallada sobre los análisis estadísticos realizados y los principales resultados encontrados.

**Conclusión:** La evaluación de la usabilidad mostró que, aunque se trata de un prototipo, la aplicación tiene una buena usabilidad y puede considerarse para uso rutinario en la autogestión de la salud. Se necesita investigación futura para verificar su eficacia.

**Descriptores:** Aplicaciones móviles. Hipertensión. Autocuidado. Diseño centrado en el usuario. Tecnología. Enfermería.

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## ■ INTRODUCTION

High blood pressure (AH), which sometimes progresses asymptotically, gives individuals the impression that they are healthy. This makes self-care a challenge, as only around 32.5% of the global population has their blood pressure levels controlled. It is estimated that 1.6 billion people will have hypertension by 2025<sup>(1)</sup>.

The management of hypertension involves the use of antihypertensive drugs, changes in diet and lifestyle habits<sup>(2)</sup>. With the popularization of the internet, access to technological resources, such as mobile applications (App) for smartphones, can be a convenient way to motivate healthy behaviors and encourage self-management of chronic non-communicable diseases, including SAH<sup>(3-5)</sup>.

Previous evidence has demonstrated satisfactory results with the use of smartphone Apps in promoting medication adherence and self-management of AH, such as research that used resources related to medication reminders, sending encouraging messages and recording Blood Pressure (BP) measurements with feedback on the recorded information<sup>(3)</sup>. Another investigation used cognitive behavioral therapy techniques to provide support and training for adopting healthy behaviors such as a proper diet, physical activity, medication adherence, sleep and stress management<sup>(6)</sup>.

A review study carried out in the United Kingdom aimed to describing, evaluating and investigating the functionalities of 186 Apps for hypertension self-management concluded that there is wide availability of applications for smartphones, with not very comprehensive functionalities, lack of evidence of usability, low participation of health professionals and theoretical support in application development<sup>(7)</sup>.

The process of developing an App involves different methodological steps, and it is essential to evaluate the quality of the ideal technology. This judgment can be made through usability assessment research using validated instruments applied to the target audience (end user) of the App<sup>(7,8)</sup>.

Usability is defined as a quality attribute that evaluates the degree of ease of use of user interfaces. Based on usability levels, software's efficiency (quickness to complete tasks), ease of use, design, learning capacity, memorization, error rates and user satisfaction when interacting with an App can be verified<sup>(8)</sup>.

According to the literature, usability problems can be impacted by the cultural context, experience, skills and knowledge of users. Therefore, it is important to evaluate the usability of an application before checking its effectiveness<sup>(9)</sup>.

The "Quali+" App was developed with the aim of supporting and motivating people with hypertension to continue pharmacological and non-pharmacological treatment<sup>(10)</sup>,

based on the Theory of Planned Behavior (TCP)<sup>(11)</sup> and beliefs related to the use of antihypertensive medications<sup>(12)</sup>. Thus, investigating the degree of technical usability by the end user of the "Quali+" App to perform a specific task (for example, entering information about medication in use), accessing educational resources and handling technology, etc. will contribute to the area of nursing and health, as it will expand the body of knowledge on the subject, by evaluating a product with the potential to be incorporated into clinical practice to support AH self-management.

This study is part of the health and well-being axis, the sustainable goals of the millennium. In light of the above, the following question arises: what is the level of usability of an App prototype for people with AH? The present study aimed to evaluate the usability of the "Quali+" mobile application prototype by end users.

## ■ METHOD

Descriptive, cross-sectional study, with heuristic evaluation of a mobile application prototype entitled "Quali+"<sup>(13)</sup>, created for mobile devices and the Android platform, which is the most used worldwide. Usability heuristics are general evaluation techniques that describe common properties in system interfaces through knowledge of psychological, computational and sociological aspects present in the interaction between user and system<sup>(14)</sup>.

The prototype of the application was developed and validated in terms of content<sup>(11,13)</sup> for individuals with hypertension and provides educational information about the disease, with features such as reminders, alarms, video, motivational messages and control of blood pressure records. The indications of the Revised Standards for Quality Improvement Reporting Excellence SQUIRE 2.0 were adapted and followed.

The study population consisted of individuals with hypertension treated in a cardiology service at a public teaching hospital, located in the city of Campina Grande, Paraíba, Brazil. According to the recommendations of the Brazilian Association of Technical Standards (ABNT) for requirements and evaluation of software products, eight or more people are indicated for usability testing<sup>(8)</sup>. A bibliometric study on validating the usability of mobile apps in healthcare reported that 33.4% of the articles analyzed carried out usability testing with up to 20 participants<sup>(15)</sup>.

Based on this evidence, a non-probabilistic and intentional sample was selected with 22 people with AH. No one refused to participate. The following inclusion criteria were adopted: be ≥ 18 years old; with medical diagnosis of hypertension, regardless of the type or stage of hypertension, daily use of

antihypertensive medication and being in possession of a personal cell phone, such as a smartphone, with installed applications in use at the time of the invitation to participate in the research. The exclusion criteria were uneducated individuals, or with cognitive impairment confirmed in medical records or with some functional difficulty that requires the assistance of caregivers/family members to use the application.

Data were collected between June and July 2021. Participants were approached at the health service while waiting for care, and asked about the diagnosis of AH, the use of antihypertensives and the use of cell phone applications in their daily lives. Participants who met the inclusion criteria and agreed to participate in the study were taken to a private room. Institutional biosafety protocols were observed, due to the new coronavirus pandemic, to ensure the safety of the researchers and volunteers involved.

For access, the prototype application was made available to participants on a smartphone device, in which it was possible to enter information about the treatment, access the audiovisual content, interact and learn about the functionalities of "Quali+", for a period of approximately 20 minutes. Subsequently, a form was applied to collect sociodemographic data (age, gender, date of birth, marital status, education, time elapsed since diagnosis of AH, length of use of antihypertensives and number of daily use tablets for AH), in addition to usability assessment with the Smartphone Usability questionnaire (SURE) instrument. The SURE was selected because it is an instrument built and based on Item Response Theory and intended for smartphones<sup>(16)</sup>.

The SURE consists of 31 items, with Likert-type response options. The options offered are: disagree; partially disagree; agree; totally agree; and does not apply, listed as follows: 1, 2, 3, 4 and 0, respectively. The sum of the scores for each item corresponds to the usability value, with a total value of up to 124 points. SURE scores are categorized into the following

levels: level 30 (possibility of totally or partially disagreeing); level 40 (possibility to agree); level 50 (no longer agree partially to strongly); level 70 (strongly agree); and level 80 (completely agree). Levels above 70 points indicate good usability<sup>(16,17)</sup>.

The data were initially distributed in an Excel spreadsheet, Microsoft Windows 2013 version, checked by peers, organized in the IBM Statistical Package for the Social Sciences (SPSS) for Windows 22.0 and presented in tables. The variables were analyzed with descriptive statistics, by simple frequency, percentage, mean and standard deviation. The sum of the values obtained by each participant who answered the SURE was also grouped and arranged according to the instrument's usability levels.

The study complied with the ethical and legal precepts governing Resolution No. 466/2012 on research carried out with human beings, of the National Health Council, was registered on *Plataforma Brasil*, according to CAAE No. 79671317.3.0000.5182 and approved by the Research Ethics Committee, under Protocol No. 2,446,615. The Free and Informed Consent Form (TCLE) was signed in two copies, the first copy being delivered to the responsible researcher and the second copy delivered to the participant.

## ■ RESULTS

Twenty-two individuals with AH participated in the usability analysis of the "Quali+" App. Most were women, 18 (81.8%), with an average age of  $48.95 \pm 10.54$ , ranging from 26 to 69 years. Nine (50.0%) were married and 10 (55.5%) had completed high school. The average time elapsed since diagnosis of the disease was  $9.55 \pm 7.67$  and the length of use of antihypertensive drugs was  $9.50 \pm 7.70$  years, with 11 (61.1%) using only one type of antihypertensive medication per day.

Table 1 shows the values obtained in the heuristic evaluation of the App prototype by end users.

**Table 1** – Participants' average score for each SURE item. Campina Grande, Paraíba, Brazil, 2021

Items	Mean (SD)	Min	Max
1. I found it easy to enter data into these applications. For example, using the "etc."	3.68 (0.56)	2	4
2. When I make a mistake it is easy to correct it.	3.59 (0.73)	2	4
3. I found the help/tips given by the app to be useful.	4.00 (0.00)	2	4
4. It was easy to find the information I needed.	3.86 (0.46)	2	4
5. I felt in charge using this app.	3.59 (0.66)	2	4
6. I found that the time taken to complete the tasks is appropriate.	3.59 (0.59)	2	4

**Table 1** – Cont.

Items	Mean (SD)	Min	Max
7. It was easy to learn how to use this app.	3.77 (0.52)	2	4
8. The sequences of actions in the app match the way I normally perform them. For example, the order of buttons, data fields, etc.	3.55 (0.51)	3	4
9. It's easy to do what I want using this app.	3.73 (0.63)	2	4
10. It was easy to navigate the app's menus and screens.	3.82 (0.51)	2	4
11. The application meets my needs.	3.86 (0.35)	3	4
12. I would recommend this app to others.	3.95 (0.21)	3	4
13. Even if I was in a hurry, I would be able to perform tasks in this application.	3.50 (0.74)	2	4
14. I found the app to be consistent. For example, all functions can be performed in a similar way.	3.50 (0.67)	2	4
15. It's easy to remember how to do things on this app.	3.68 (0.64)	2	4
16. I would use this app frequently.	3.68 (0.47)	3	4
17. The organization of menus and action commands (such as buttons and links) is logical, which allows you to easily find them on the screen.	3.73 (0.45)	3	4
18. I was able to complete the tasks successfully using this app.	3.77 (0.61)	2	4
19. I enjoyed using this app.	3.82 (0.39)	3	4
20. The application provides all the information necessary to complete tasks in a clear and understandable way.	3.82 (0.39)	3	4
21. I found the app very difficult to use.	1.14 (0.56)	0	3
22. The symbols and icons are clear and intuitive.	3.77 (0.42)	3	4
23. I found the texts easy to read.	3.91 (0.29)	3	4
24. I found the app unnecessarily complex. I had to remember, research or think a lot to complete the tasks.	0.95 (0.57)	0	3
25. The terminology used in texts, labels, titles, etc. is easy to understand.	3.73 (0.93)	0	4
26. I would need someone's support to use this app.	1.64 (1.04)	1	4
27. I felt comfortable using this app.	3.77 (0.52)	2	4
28. The app behaved as I expected.	3.77 (0.42)	3	4
29. I found it frustrating to use this application	1.05 (0.21)	1	2
30. I found the various functions of the application to be well integrated.	3.82 (0.39)	3	4
31. I felt very confident using this app.	3.82 (0.50)	2	4

Source: Research data.

SD: Standard deviation; Min.: Minimum; Max. Maximum.

The overall usability average, adding the SURE scores, was  $105.8 \pm 7.44$ ; with 113 being the highest observed usability value and 83 being the lowest. In the evaluation of individual SURE scores, it was found that 100% of those

investigated were categorized at level 80, which indicates that the participants fully agreed that the help/tip provided by the app would be useful and the other items evaluated (Table 2).

**Table 2** – Distribution of scores and usability level of participants. Campina Grande, Paraíba, Brazil, 2021

Participants	Age	Gender	Total SURE score	Usability level
1	52	Female	99	80
2	56	Female	108	80
3	57	Female	108	80
4	44	Female	112	80
5	42	Female	112	80
6	63	Male	95	80
7	53	Female	106	80
8	39	Female	104	80
9	50	Female	106	80
10	26	Female	112	80
11	44	Male	111	80
12	59	Female	83	80
13	69	Female	99	80
14	49	Female	109	80
15	45	Male	106	80
16	30	Female	103	80
17	64	Female	97	80
18	43	Female	112	80
19	41	Male	111	80
20	44	Female	112	80
21	52	Female	111	80
22	55	Female	113	80

Source: Research data.

## ■ DISCUSSION

This study aimed to evaluate the usability of an application prototype for the intake of oral antihypertensives by individuals with AH. The use of mobile applications has the potential to facilitate communication between people and assist in everyday tasks<sup>(18)</sup> and also motivate the search for a better quality of life. The incorporation of technological resources in the health area as a support tool has shown satisfactory evidence in the management of chronic diseases<sup>(19)</sup>, improving adherence to treatment<sup>(20)</sup> and encouraging healthy behaviors<sup>(21)</sup>. Due to its relevance, it is essential that the App has good usability, in order to ensure that the technological artifact is efficient and satisfies end users.

Methodological study carried out in São Paulo with 30 participants on the development and evaluation of App usability reported an average age for respondents of 29.7 years<sup>(22)</sup>. In the present study, in contrast, the average age of the participants was higher, 48.95 years old, which indicates the ease of handling the application without limiting age as a factor that hinders its use. Furthermore, the increasing technological rise and insertion in different contexts of life have demonstrated the adherence of elderly people to the digital world<sup>(23)</sup>.

Women represented 81.8% of the respondents in this study, a predominance that occurs in other studies<sup>(17,24)</sup>. It is assumed that this recurrence is attributed to the increased frequency with which women seek health services and their greater concern regarding the control of chronic diseases, especially AH.

Another aspect that deserves consideration is the educational level of the participants. In the distribution shown, the usability of the "Quali+" prototype was well evaluated at all levels of education, corroborating cross-sectional mixed methodology research that built and evaluated an App prototype for children's health<sup>(25)</sup>. This reflects the fact that the application is easy to understand and handle. It was designed to be intuitive and applicable to the different social groups affected by SAH, without requiring high levels of education.

The data from the "Quali+" application evaluation shows a maximum usability score (level 80), in different age groups, demonstrating its good acceptance by the target audience, people diagnosed with SAH. This reflects the quality of the software developed, in which no usability problems were identified.

Positive and satisfactory responses were obtained for the majority of the 31 items analyzed. This finding corroborates the results of a study that attempted to evaluate the usability of an application prototype for diabetic foot, using the SURE

instrument<sup>(17)</sup>, with an average usability of 96.1 points. Thus, it is important to use appropriate methodological tools to evaluate interface, content, language and user satisfaction.

In item 3, participants fully agreed that the help/tips provided by the application would be useful, which reinforces the relevance of creating technologies that encourage adherence to treatment and self-management of chronic diseases. This finding corroborates items 12 and 23, as most respondents would recommend the prototype to other people and considered the texts easy to read.

It is assumed that the use of accessible, objective and precise language in the construction of the prototype will help users with HA to frequently access the technology's functionalities, which reinforces the indispensability of validating the content of applications before evaluating usability, as previously carried out. previously with "Quali+"<sup>(11,14)</sup> and an application to promote self-care for patients with heart failure<sup>(26)</sup>. In contrast, research that evaluated the usability of apps for diabetes self-management highlighted usability problems such as aesthetic and minimalist design, tips or self-help resources that were too long or not useful, and help functions that were not available<sup>(27)</sup>.

The construction of an App with practical and easy-to-use functionalities<sup>(10)</sup> enables usability for the population living with a diagnosis of AH who, in general, have impaired functional health literacy, as the profile is associated with low educational level and advanced age<sup>(28)</sup>. The inclusion in the App<sup>(10)</sup> of validated audiovisual tools with clear and objective language for all audiences can facilitate understanding and assimilation of the message, contributing to improved knowledge and self-care in HA.

In this study, participants obtained lower scores in the items in which they found it difficult to use the application (item 21), support from third parties in handling the application (item 26) and frustration in using the application (item 29), which reinforces the quality of the technology produced. Therefore, the easier it is to perform tasks and handle resources, the greater the chances of use by the end user. This finding is similar to that of a survey carried out with 22 participants in Saudi Arabia that evaluated the acceptance and usability of the application for self-management of AH. Users rated the application as a useful tool, were satisfied with the interface and stated that it was easy to use<sup>(29)</sup>. Thus, the usefulness of the application, as a health self-management tool, satisfies users as it offers an interesting interface, which facilitates the use of the App.

The present study has some limitations, as the results reflect the evaluation of participants in outpatient follow-up at a single center and in a cross-sectional manner. Therefore,



they must be evaluated with caution. It is suggested that further investigations be carried out in other scenarios, to confirm or refute the results obtained in this investigation.

It should be noted that the motivational effects of technology for adherence to AH treatment were not measured. Therefore, this study encourages further research to verify the effectiveness of “Quali+”, in the medium and long term, and its impact on adherence to medication therapy, self-care and quality of life of users.

The greater contact of nurses and health professionals with the area of information technology has proven successful in the development of applications for health care. For nursing and health practice, “Quali+” is a tool with potential for use, combined with health education actions, developed for self-management of AH, and the user’s feeling of belonging in controlling their own health.

## ■ CONCLUSION

The “Quali+” application prototype obtained an average score of 105 points, showing a good level of usability, which indicates usefulness, viability and ease of use by users, when learning about and handling the technology’s functionalities. It is expected that the application will be incorporated into mobile devices to support health educational actions in clinical practice, in order to promote knowledge and enhance self-management of AH. The need for future research is considered to verify the effects of technology, in the medium and long term, on people with AH.

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