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RESEARCH ARTICLE (ORIGINAL) 🔓

Development and Feasibility of the Kendali-HT Web Application for Families of Older Adults with Hypertension

Desenvolvimento e Viabilidade da Aplicação Web Kendali-HT para Famílias de Idosos com Hipertensão Arterial

Desarrollo y Viabilidad de la Aplicación Web Kendali-HT para Familias de Personas Mayores Hipertensas

Ni Luh Putu Dian Yunita Sari [1]
https://orcid.org/0000-0001-6726-0681

Ni Made Dwi Ayu Martini [1]
https://orcid.org/0000-0002-6273-0856

I Kadek Prastikanala [1]
https://orcid.org/0000-0002-8144-7044

[1] STIKES Bina Usada Bali, Badung, Bali, Indonesia

Abstract

Background: Hypertension remains a health problem with the potential to be a burden for the families of older adults due to the high risk of complications. Families need effective media to support the management of older adults with hypertension at home.

Objective: This study aims to develop and assess the feasibility of the Kendali-HT web application.

Methodology: This study used a Research and Development (R&D) approach, which aims to develop and test the effectiveness of a product, with the ADDIE model. The analysis and design stages used a qualitative approach; the development stage consisted of the development of an application; and the implementation and evaluation stages used quantitative methods.

Results: Three themes emerged during the analysis stage. The subsequent stage produced a web -application based on Riegel's theory. Finally, in the evaluation stage, the application was rated as having good feasibility.

Conclusion: This application is expected to serve as a tool to educate families and increase self-management behaviors of older adults with hypertension at home.

Keywords: aged; family; hypertension; technology

Resumo

Enquadramento: A hipertensão arterial continua a ser um problema de saúde que pode presentar um fardo para as famílias de idosos devido ao elevado risco de complicações. As famílias necessitam de ferramentas de comunicação eficazes para ajudar a monitorizar os idosos hipertensos em casa.

Objetivo: Desenvolver e determinar a viabilidade da aplicação Web Kendali-HT.

Metodologia: Este estudo utiliza a abordagem de Investigação e Desenvolvimento (I&D), que visa desenvolver e testar a eficácia de um produto, recorrendo ao modelo ADDIE. As etapas de análise e design utilizam uma abordagem qualitativa; a etapa de desenvolvimento consiste no processo de criação da aplicação; e as etapas de implementação e de avaliação utilizam métodos quantitativos.

Resultados: Foram identificados três temas na etapa de análise. A etapa seguinte resultou numa aplicação web, que também se baseia na abordagem da teoria de Riegel. Por fim, na fase de avaliação, a viabilidade da aplicação foi considerada boa.

Conclusão: Espera-se que esta aplicação seja uma forma de educar as famílias e aumentar o comportamento de autogestão em casa.

Palavras-chave: idoso; família; hipertensão; tecnologia

Resumen

Marco contextual: La hipertensión sigue siendo un problema de salud que puede suponer una carga para las familias de personas mayores debido al elevado riesgo de complicaciones. Las familias necesitan medios eficaces para ayudar a controlar a las personas mayores hipertensas en casa.

Objetivo: El objetivo de este estudio es desarrollar y determinar la viabilidad de la aplicación web Kendali-HT.

Metodología: Este estudio utiliza el enfoque de Investigación y Desarrollo (I+D), cuyo objetivo es desarrollar y probar la eficacia de un producto, con el modelo ADDIE. Las etapas de análisis y diseño utilizan un enfoque cualitativo, la etapa de desarrollo es el proceso de desarrollo de una aplicación, mientras que las etapas de implementación y evaluación utilizan métodos cuantitativos.

Resultados: Se encontraron tres temas en la etapa de análisis. La siguiente etapa dio lugar a una aplicación web y en el enfoque de la teoría de Riegel. Por último, en la fase de evaluación, la categoría de viabilidad de la aplicación se consideró buena.

Conclusión: Se espera que esta aplicación sea un medio para educar a las familias a fin de aumentar el comportamiento de autogestión en el hogar.

Palabras clave: anciano; familia; hipertensión; tecnología

Corresponding author
Ni Luh Putu Dian Yunita Sari
E-mail: dianyunitaputu@gmail.com

Introduction

Indonesia has entered an aging population structure, with the percentage of older people reaching 11.75% in 2023 (Central Statistics Agency of Indonesia, 2023). The increase in the number of older people has positive implications if they are healthy, active, and productive. However, the aging process causes several physical declines that have the potential to be risk factors for degenerative diseases (Li et al., 2021).

The most common degenerative disease experienced by older adults is hypertension. According to the 2018 Indonesian basic health research survey, the age group with the highest prevalence of hypertension was 55-64 years, at 55.2% (Ministry of Health of the Republic of Indonesia, 2019). This phenomenon is a challenge in itself because hypertension is one of the major risk factors for catastrophic diseases.

Hypertension is called the *silent killer* because most individuals do not experience symptoms (Balwan & Kour, 2021)there are very minor symptoms or no symptoms at all. Some of the signs you must look out for are difficulty in breathing, chest pain or heaviness, headaches, irregular heartbeat (palpitation. This condition is dangerous because individuals do not take curative or self-care measures, so the possibility of complications is greater (Ginting et al., 2024). Even some older people who routinely take antihypertensive drugs experience blood pressure fluctuations. This is because hypertension is influenced by multiple factors, especially diet, rest, stress management, and smoking and alcohol consumption habits (Charchar et al., 2024). This condition has the potential to trigger complications. Therefore, an innovative solution is needed to prevent complications in older patients with hypertension by controlling blood pressure. The purpose of this study was to develop and assess the feasibility of the Kendali-HT web application.

Background

The Indonesian government has made several efforts to control the blood pressure of hypertensive patients. One initiative is the Healthy Indonesia Program, which uses a family approach. However, a study evaluating hypertension indicators reported that only 37.16% of hypertensive patients received regular treatment (Hartina et al., 2022). In addition, a study evaluating hypertension in Bali Province found that patients receiving regular treatment had the lowest achievement rate, at 30.92% (Adnyani et al., 2023). These data suggest that an additional approach is needed to improve the self-management of hypertensive patients.

The alternative solution proposed to address this research phenomenon is a technology-based intervention with an integrative approach based on several theoretical concepts and nursing models, referred to as Kendali-HT. The problem-solving approach used in this study is Riegel's Theory of Self-Care of Chronic Illness, which consists of self-care monitoring, self-care management, and self-care mainte-nance (Riegel et al., 2024). A previous study provided an eight-week mobile-based self-management intervention entitled "Green Heart App", which significantly improved blood pressure and dyslipidemia management (Ghavami et al., 2024). Thus, technology-based interventions offer positive implications for hypertensive patients. However, previous evaluation studies show that several hypertension self-care applications are focused on patients themselves and do not target families.

Kendali-HT, an abbreviation for Family Responsive and Caring for Hypertensive Elderly in the Indonesian Language, is a web application that aims to increase family capacity in supporting the self-care of hypertensive older adults.

Research question

What is the current status of the development and feasibility of the Kendali-HT web application for families of older adults with hypertension?

Methodology

Researchers followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, using the 22-item checklist to ensure the feasibility of this article (Vandenbroucke et al., 2024). This study also used a Research and Development (R&D) approach with the ADDIE model, which has five stages: Analysis, Design, Development, Implementation, and Evaluation (Crompton et al., 2024).

1 - Analysis

The analysis stage was carried out to explore the need for developing an application to help families in caring for older patients with hypertension. The method used in this stage was the Focus Group Discussion (FGD) involving 10 nurses responsible for the non-communicable disease program and the elderly care program. Data collection was conducted by audio-recording the discussion, which lasted approximately 40-65 minutes. This process continued until the point of theoretical saturation was reached. Data were analyzed using a thematic analysis method that involved transcribing verbatim for detailed analysis, searching for codes and meaningful statements, and establishing subthemes and themes. Researchers used the NVivo version 12 software. The Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist was used as an interview guide to ensure the feasibility of this process (Tong et al., 2007)health care providers, policy makers and consumers. Although partial checklists are available, no consolidated reporting framework exists for any type of qualitative design. To develop a checklist for explicit and comprehensive reporting of qualitative studies (indepth interviews and focus groups. The targeted output in this stage was the identification of the problem locus and the materials needed to overcome the problem.

2 - Design

The first activity involved a discussion about the application's menu, the material to be presented in each menu, the navigation structure, and the arrangement of backgrounds, images, characters, videos, and support group menus. Discussion activities were carried out with five families of older individuals with hypertension and five nurses in charge of non-communicable disease programs and elderly care programs. The targeted output in this stage was the development of an application blueprint with a clear navigation structure aligned with the theoretical framework and nursing model used.

3 - Development

This stage consisted of creating an application prototype in the form of an application blueprint based on the FGD results obtained at the design stage. This stage involved the application development team over the course of one month. The targeted output in this stage was the Kendali-HT application, prepared and ready to be tested with respondents.

4 - Implementation

This stage was conducted by testing the application with 30 families of older adults with hypertension, which provided sufficient justification for a quantitative analysis of the results (Cohen et al., 2018). The sample inclusion criteria in this stage were cooperative family members, those who were able to operate smartphones or laptops, families who lived with older people with hypertension, cooperative families, and communicative families. The exclusion criteria were families of older adults who experienced cognitive and mental disorders. This stage provides an overview of whether this application was easy to access and install on the respondents' devices. Respondents completed five closed-ended questions via Google Forms.

5 - Evaluation

The feasibility test analysis of the Kendali-HT application was carried out at this stage. This test involved a sample of 35 families with older people with hypertension. The sample size was calculated using a formula based on the mean difference of two paired populations, with supporting data obtained from previous studies (Nurhasanah et al., 2022). The respondents in the evaluation stage differed from those in the implementation stage, although the same inclusion and exclusion criteria were applied. The instrument used for the feasibility test was the System Usability Scale (SUS), with a total of 10 statements, which has been validated and shown to be reliable in previous research (Sari et al., 2023). The SUS consists of 10 items rated on a five-point scale, reflecting the degree of agreement about the product being tested (Hidayat et al., 2022).

This study adhered to research ethics principles and ensured that no potential harm occurred during the process. This study received ethical approval by the Health Research Ethics Committee of STIKES Bina Usada Bali, under the Ethical Approval No. 084/EA/KEPK-BUB-2025 on March 5, 2025.

Results

The results of this study are described according to the five stages carried out.

1 - Analysis

The following table presents a thematic analysis derived from the analysis stages (Table 1). The coding strategy was conducted by two researchers with previous research experience on elderly hypertension, namely NLPDYS and NMDAM. Meanwhile, IKP reviewed the codes found.
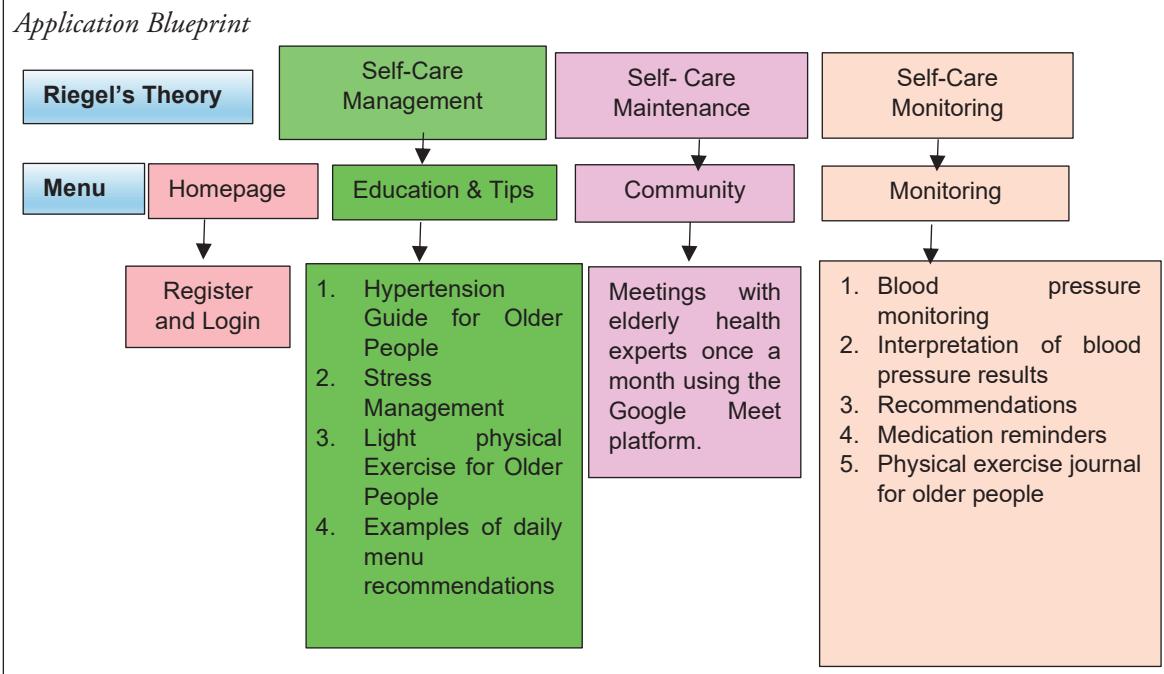
Table 1

Results of the Thematic Analysis Derived from the Analysis Stages

Statement	Subtheme	Theme
"I feel that programs for families are very important, but there aren't any yet..." (P3)	No programs for families yet	The urgency of having a health program for families
"Many families are afraid of developing hypertension like the elderly, but they don't know how to prevent it..." (P5)		
"Some family members are afraid that stroke complications will occur." (P1)	Fear of stroke complications	
"I think what is quite scary is when a stroke occurs and the burden on the family increases." (P2)		
"I don't know why many elderly people take medication regularly, but their blood pressure is not yet under control." (P6)	Uncontrolled blood pressure despite taking medication	
"In my work area, there is an elderly person who is very diligent in checking and taking medication, but his blood pressure is always above 140/90 mmHg..." (P9)		
"We have difficulty gathering the family because we are busy working..." (P2)	Family members' busyness	Barriers to home monitoring
"Some families are busy with their daily routines and do not really understand how to manage elderly hypertension at home..." (P7)		
"I sometimes find it difficult to reach the family because I feel that elderly people with hypertension are fine." (P4)	Family assumptions about illness	
"There is a feeling of rejection if you provide conventional education to families because it is considered a waste of their productive time." (P10)		
"I feel that some families of older individuals are not actively seeking information on how to care for elderly people with hypertension at home." (P8)	Family attitudes in helping elderly self-management	
"Many families of older individuals with hypertension still have unhealthy lifestyles, for example consuming fatty foods and foods high in salt..." (P3)		
"I think that with today's sophisticated technology, there should be an opportunity to develop health programs" (P4)	The potential of the technological approach	Web-applications as a problem-solving approach
"technology becomes an opportunity to address the challenge of self-care management for older patients with hypertension at home" (P5)		
"I think everyone is using smartphones now" (P9)	Preferences for appropriate technology types	
"I think all families in my work area have cell phones that can access the internet" (P6)		
"it seems that a technology, such as a smartphone application, could be considered..." (P10)		
"I am more comfortable with web applications." (P7)		

2 - Design

The design stage aimed to finalize the application blueprint based on Riegel's Theory of Self-Care of Chronic Illness (Figure 1). The application name was also agreed upon in this process, resulting in the name Kendali-HT, which was developed as a web application.

Figure 1

Application Blueprint

| Riegel's Theory | Self-Care Management | Self-Care Maintenance | Self-Care Monitoring |

| Menu | Homepage | Education & Tips | Community | Monitoring |

| | Register and Login | 1. Hypertension Guide for Older People 2. Stress Management 3. Light physical Exercise for Older People 4. Examples of daily menu recommendations | Meetings with elderly health experts once a month using the Google Meet platform. | 1. Blood pressure monitoring 2. Interpretation of blood pressure results 3. Recommendations 4. Medication reminders 5. Physical exercise journal for older people |

3 - Development

The development stage was carried out over the course of one month by the application development team. The website domain is http://kendali-ht.my.id/, which includes a homepage, a community menu, an education and tips menu, and a monitoring menu.

As shown in Figure 2, the homepage allows families of older people with hypertension to register by entering their username, WhatsApp contact, email address, home address, and the name and age of the older person being cared for. This account is required to access the other menus in the application. The community menu displays the schedule of the monthly sharing sessions with researchers related to the self-management of older people with hypertension.

The next menu is the Education & Tips menu, which provides essential information for families of older adults with hypertension to help with self-management at home. The Monitoring menu allows families to track the older adult's hypertension status and receive recommendations for action. In addition, families can set medication reminders for older people and record a journal of the physical exercises performed by them.

Figure 2

Kendali-HT Homepage

4 - Implementation

The results of the implementation phase are described in Table 2.

Table 2

Results of the Implementation Phase (n = 30)

Question	Answer	Frequency (person)	Percentage (%)
Is this application easy to access?	No	0	0%
	Yes	30	100%
Are there any obstacles during the registration process?	No	28	93.3%
	Yes	2	6.7%
Are there any obstacles during the login process?	No	0	0%
	Yes	30	100%
Are all menus in this application usable?	No	0	0%
	Yes	30	100%
Are all information displayed clearly visible?	No	0	0%
	Yes	30	100%

Two respondents reported experiencing difficulties during the registration process. After receiving clarification and assistance from the application development team, both respondents were able to register their accounts.

5 - Evaluation

The evaluation stage consisted of testing the application's feasibility using the SUS (Table 3).

Table 3

Summary of Respondents' Answers (n = 35)

Statement	Answer					Total
	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	
S1	0	1	2	29	3	35
S2	3	28	2	2	0	35
S3	0	1	2	29	3	35
S4	2	29	2	2	0	35
S5	0	1	2	30	2	35
S6	1	32	1	1	0	35
S7	0	1	0	32	2	35
S8	2	31	1	1	0	35
S9	0	1	5	27	2	35
S10	3	5	10	15	2	35
	11 3,1%	130 37,2%	27 7,7%	168 48%	14 4%	350 100%

Note. SD = Strongly disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly agree.

The next stage after analyzing the respondents' answers was to convert the data into SUS scores by subtracting one from the total for each odd-numbered statement (X-1) and subtracting five from the total for each even-numbered statement (5-X). The results of this stage are explained in Table 4.

Table 4

Average Value of Each Statement (n = 35)

No.	SUS Response Scale							
	0	1	2	3	4	5	Respondents	Mean
S1	0	1	2	29	3	0	35	2.97
S2	0	2	2	28	3	0	35	2.91
S3	0	1	2	29	3	0	35	2.97
S4	0	2	2	29	2	0	35	2.88
S5	0	1	2	30	2	0	35	2.94
S6	0	1	1	32	1	0	35	2.94
S7	0	1	0	32	2	0	35	3
S8	0	1	1	31	2	0	35	2.94
S9	0	1	5	27	2	0	35	2.85
S10	2	15	10	5	3	0	35	1.77

Note. S = Statement.

The final stage of the application feasibility analysis was to multiply all the mean item scores by 2.5 and then sum the resulting values. The final score obtained from the application feasibility analysis was 70.425, which falls within the *good* rating category, meaning that this application is well received.

Table 5

Results of the Application Feasibility Analysis (n = 35)

No.	Average x 2.5	Amount
S1	2.97 x 2.5	7.425
S2	2.91 x 2.5	7.275
S3	2.97 x 2.5	7.425
S4	2.88 x 2.5	7.2
S5	2.94 x 2.5	7,35
S6	2.94 x 2.5	7.35
S7	3 x 2.5	7.5
S8	2.94 x 2.5	7.35
S9	2.85 x 2.5	7.125
S10	1.77 x 2.5	4.425
Application Feasibility Score		**70.425**

Note. S = Statement.

Discussion

The results of this study indicate that families of older adults need alternative media to support hypertension self-management at home. Another study suggests that technology can be a solution for long-term care of older adults and support their social interactions (Long et al., 2024)further research is warranted to clarify the mechanisms through which technological interventions may decrease loneliness. This study aimed to better understand the perspectives of older adults on the role of technology in their social relationships in later life. Four focus groups were conducted with 27 older adults, aged 65–80 years. Transcripts were analysed using thematic analysis, and results were validated via written participant feedback. Participants reported technology as one of many tools used to maintain their social relationships. Their choice to use technology for social interaction was influenced by their estimation of effort required, likely quality of the interaction, and the privacy and security provided. These factors were the same as those that influenced decisions to use other methods (e.g. face-to-face meetings. In addition, other research states that assistive technology can help families in caring for older adults with limited mobility (Choi et al., 2024). Other studies have developed technologies for other chronic diseases such as diabetes, with the same goal of controlling blood glucose (Cai et al., 2025). Therefore, a technology-based approach is

an alternative solution to the problem identified in this research.

The application development is integrated with the middle-range nursing theory framework, namely Riegel's Theory of Self-Care of Chronic Illness (Riegel et al., 2024). The core components of this theory are self-maintenance, self-monitoring, and self-management. These three elements form the basis for developing the menus in the application. This is consistent with several previous studies. However, no research to date has directly integrated this theory into application development, especially for families of older adults with hypertension. Previous studies have stated that several types of technology, such as artificial intelligence, blockchain, and wearable devices(Adepoju et al., 2025). In addition, other studies also state that mobile applications can increase adherence to self-care behaviors and health literacy (Son & Kim, 2023). The Kendali-HT application contains several menus that allow families to help older adults control their blood pressure at home. In the Education and Tips menu, there are several submenus, namely hypertension guide for older people, stress management, light physical exercise for older people, and examples of daily menu recommendations. The contents of this application are in line with previously developed mobile-based technologies (Harun et al., 2024). In addition, this application also provides a regular blood pressure monitoring menu, which is in line with previous research (Alam et al., 2024). This application also offers consultations via Google Meet in the community menu, which aligns with previous research that implemented coaching using an intelligent health promotion system and WeChat (Sun et al., 2024) physical activity (PA. Thus, although some of these studies support approaches similar to the development of the Kendali-HT application, they are not specifically aimed at families of older people with hypertension.

The feasibility of the Kendali-HT application has been tested and is categorized as good. This finding is consistent with several studies that have assessed the feasibility of digital applications. One previous study found that a mobile application developed for managing hypertension during pregnancy received an average System Usability Score of 81, which also falls within the good category (Wills et al., 2025). In addition, other research found that the WHISE mobile application has good feasibility, with 80% of respondents indicating that it is an effective tool for the self-management of hypertension (Jones et al., 2024). Some of these studies indicate that there is a need for digital tools to support patients with hypertension in managing their condition.

The development of the Kendali-HT application has gone through several stages and has been adjusted to meet the needs of the community. Several previous studies have developed applications to help with medication adherence and self-management of older adults with hypertension. However, none have been specifically designed for families who care for older adults with hypertension. This represents a new aspect of the application developed in this study for the self-management of hypertension, especially in families of older adults with hypertension.

This application also has the potential to be implemented internationally because it is web-based and includes a translation feature in other languages.

The limitations of this study were not further examined, namely if this application could effectively improve the health status, family independence, or self-management of older people with hypertension. Furthermore, the sample size used was small and the test was short-term. Thus, further studies using a randomized controlled trial (RCT) design or a longitudinal approach are recommended.

Conclusion

This study found that the feasibility of the Kendali-HT application falls within the good category. This result indicates that this application can be used easily by families of older people with hypertension. The findings suggest that this application has the potential to support nurses in addressing the challenges of controlling blood pressure in older people with HTA through a technology-based family approach. It can also be used in community nursing service settings, including home visits and community-based interventions.

Author contributions
Conceptualization: Sari, N. L., Prastikanala, I. K.
Data Curation: Sari, N. L., Martini, N. M., Prastikanala, I. K.
Formal Analysis: Sari, N. L., Martini, N. M.
Funding Acquisition: Sari, N. L., Prastikanala, I. K.
Investigation: Sari, N. L., Martini, N. M.
Methodology: Sari, N. L.
Project Administration: Sari, N. L., Martini, N. M., Prastikanala, I. K.
Resources: Sari, N. L., Martini, N. M., Prastikanala, I. K.
Software: Sari, N. L., Prastikanala, I. K.
Supervision: Sari, N. L., Prastikanala, I. K.
Validation: Sari, N. L., Martini, N. M.
Visualization: Sari, N. L., Martini, N. M.
Writing – Original Draft: Sari, N. L., Prastikanala, I. K.
Writing – Review & Editing: Sari, N. L.

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