The development of self-management among patient with heart failure by using health application

Suthipong.C, PhD[1*], Boonyapat.P, PhD[2], Vipada, PhD[3], Somporn Kaewnim[4], Oranuch Thammasorn[5]

[1,2,3]School of Nursing, Mae Fah Luang University, Hiang Rai, Thailand
[4,5]Cardiac Nurse Specialist Nan Hospital, Nan District, Thailand

Abstract

Heart failure is a major global health concern that requires effective self-management to reduce complications and hospital readmissions. The purpose of this study was to develop a health application prototype to support self-management among patients with heart failure. This study operated in 2 phase: 1) to anylyze the need for development a moblie application to assit the Heart Failure patients' self management at home by collecting qualitative data through in-depth interview among 60 participants, including healthcare professionals and patients/caregivers; 2) to develop the prototype of the Heart Failure application for heart failure patients by syntheszing the data from pheae 1 combined with litearture review to design the application. The indept interview data were analyzed by using thematic analysis method. The demographic data were analyzed by using descriptive statistic. The Ethical Research Committee approved the study. The results illustraed that the key requirements for the application, such as need an application can provide appointment scheduling notification and the behavior advice, self-adjusting medication, video-based guidance, offline functionality, and emergency notifications. The application should have a simple and user-friendly format, while healthcare professionals emphasized the importance of patient identification and providing comprehensive knowledge and understanding of the disease's pathology. Based on these findings, a prototype health application was developed with features tailored to the needs of patients with heart failure. In Conclusion, the development of health application prototype used needs-based to provides a promising tool to enhance self-management and improve quality of life for patients with heart failure. The findings highlight the value of user-centered design in creating effective digital health solutions for chronic disease management.

Keywords: Heart failure, Self-care, Mobile applications, Telemedicine, Qualitative research

Statement of the Problem

Heart failure is a critical global public health issue, primarily caused by cardiovascular diseases. According to the Global Burden of Disease (GBD) report, approximately 64.3 million people worldwide suffer from heart failure, with a prevalence rate of around 1% of the total population.[1] In Thailand, the Ministry of Public Health reported a rising trend in hospital admissions for heart failure between 2013-2015, with rates of 266, 265, and 292 per 100,000 population, respectively.[2,8]

Heart failure occurs when the heart cannot pump sufficient blood to meet the body's needs, leading to complex clinical symptoms. This condition often results from structural or functional heart inefficiencies, causing insufficient blood circulation to tissues or inadequate blood return to the heart.

Symptoms include shortness of breath, difficulty lying flat, nighttime fatigue, fluid overload, pulmonary congestion, and peripheral edema, often

requiring emergency hospital admissions.[3] Volume overload, characterized by rapid extracellular fluid increase, stems from excessive water or sodium intake. This overload strains the heart, exacerbating heart failure. Symptoms include peripheral edema, abdominal swelling, pulmonary edema, elevated jugular venous pressure, and significant weight gain within a short period. Sensitivity and specificity of symptoms vary, with shortness of breath being highly sensitive but less specific, while nocturnal dyspnea is more specific but moderately sensitive. Key diagnostic and prognostic indicators include natriuretic peptides like elevated BNP and NT-pro BNP levels.[4]

The American Heart Association (AHA) and the European Society of Cardiology (ESC) emphasize risk factor control and health behavior modifications to manage heart failure, prevent complications, slow disease progression, and improve patient quality of life through medication and medical technologies.[5] Despite sufficient healthcare personnel in Thailand, disparities in service access persist due to geographic

and economic factors.[6,9]

Self-management is crucial for heart failure patients, involving dietary sodium restriction, daily symptom monitoring, and medication adherence. Challenges include inadequate patient education, inconsistent self-monitoring, and lack of support for managing fluid overload.[7] Technology and telehealth solutions, such as mobile health applications, enhance self-management by providing real-time health monitoring and feedback, improving outcomes, and reducing hospital readmissions.[6]

This research aimed to develop a self-management system for heart failure patients using a health application, leveraging technology to support patient and family engagement, and ensuring equitable healthcare access. The findings informed policy and strategy adjustments for systematic health promotion and equal service access.

Research objectives

Primary Objective To develop a self-management system model for heart failure patients using a health application in Thailand.

Secondary objectives

- To study the current situation and needs for self-management among heart failure patients using a health application.
- To develop a prototype application for enhancing self-management among heart failure patients.

Purpose of the study

This study aimed to develop an application tailored to the self-management needs of heart failure patients. Data were collected qualitatively through in-depth interviews to assess the problems and needs of heart failure patients and healthcare teams in Health

Region 1. The study included 60 participants from Chiangrai Prachanukroh Hospital, Mae Fah Luang Medical Center, Nan Hospital, and Chiang Kham Hospital. The gathered data guided the development of an application model to enable effective self-care for heart failure patients.

Scope of the research

This study focuses on developing an application tailored to the self-management needs of heart failure patients. Data will be collected qualitatively through in-depth interviews to assess the problems and needs of heart failure patients and healthcare teams from hospitals in Health Region 1. The hospitals involved include Chiangrai Prachanukroh Hospital, Mae Fah Luang Medical Center, Nan Hospital, and Chiang Kham Hospital, with a total of 60 participants. The collected data will guide the development of an application that enables effective self-care for heart failure patients.

Research Methodology

This research follows a research and development (R&D) approach and will be conducted in three phases:

Phase 1: Preparation and contextual study on symptom management for heart failure patients

Research 1 (R1) 1.1 Submit the research proposal for ethical approval and obtain permission to collect data in hospitals. 1.2 Conduct meetings with relevant healthcare staff to explain the research objectives, procedures, and the rights of participants, and obtain informed consent. 1.3 Assess problems and needs related to symptom management through in-depth interviews with healthcare staff involved in the care of heart failure patients. Conduct focus group discussions with patients or primary caregivers to explore concepts and feasibility, involving 10 participants or until data saturation is reached.

Phase 2: Development of the self-management system using a health application 2. Research 2 (R2)

2.1 Develop the self-management system by synthesizing findings from Phase 1 and reviewing relevant literature to establish an initial framework. Validate the content with three experts and relevant stakeholders, including doctors, nurses, and patients or primary caregivers. Revise the system based on feedback and pilot it with 10 heart failure patients. Assess the accuracy and reliability of the data, analyze the content based on Donabidian's framework, and plan system development. Evaluate

and refine the system to achieve a comprehensive self-management model.

Protection of participants' rights

This research, after receiving approval from the Human Research Ethics Committee of Mae Fah Luang University (Certificate No. EC 23241-19), submitted the research proposal for permission and certification from the Human Research Ethics Committees of Chiangrai Prachanukroh Hospital, Nan Hospital, Chiang Kham Hospital, and Mae Fah Luang University. Adhering to the Helsinki Declaration, the researcher protected the rights of all participants by introducing themselves and explaining the research objectives, data collection procedures, research duration, potential benefits, and possible impacts. Once participants understood and agreed to participate, they were asked to sign a consent form voluntarily, without any coercion. Non-participation would not affect their usual care, and they could withdraw from the study at any time without any repercussions. Additionally, the researcher emphasized the confidentiality and safety of the data, which would be securely stored, coded, and inaccessible to unauthorized persons. The data would be destroyed one year after the completion of the project. The presentation of results would be in aggregate form as academic information only.

Data analysis

Data analysis was divided into quantitative and qualitative analysis. Quantitative data included personal information and data from in-depth interviews. The analysis were analyzed by using thematic analysis method with the participants and healthcare staff involved in the care of heart failure patients, according to the research objectives. Details are as follows:

Research Results

This study aimed to develop a self-management system for heart failure patients using a health application in Health Region 1, with 60 participants. The study results are as follows:

Among the 60 participants, 65% were female, 58% were Christian, 42% were married, 40% had no formal education, 30% were farmers, 58% had a monthly income of less than 2,000 baht, and 58% were covered by universal health insurance. The data is presented in Table 1.

Table 1. Number and percentage of participants classified by general information

General Information	Number (Percentage)
Gender	
Female	39 (65%)
Male	21 (35%)
Religion	
Christian	35 (58%)
Buddhist / Muslim	25 (42%)
Marital Status	
Married	25 (42%)
Widowed	17 (28%)
Single	12 (20%)
Separated / Divorced	6 (10%)
Highest Education Level	
No Formal Education	24 (40%)
Primary Education	6 (10%)
Secondary Education	15 (25%)
Diploma/Bachelor's Degree	15 (25%)
Occupation	
Unemployed	12 (20%)
Employee	15 (25%)
Agriculture	20 (30%)
Private Business/Government Employee/State Enterprise	15 (25%)
Monthly Income (Baht)	
Less than 2,000	35 (58%)
2,001 - 5,000	8 (13%)
5,001 - 10,000	5 (8%)
More than 10,000	12 (21%)
Healthcare Rights	
Self-Paying	5 (2%)
Prepaid Health Insurance Card	35 (58%)
Government/State Enterprise Employee Benefits	15 (25%)
Social Security	15 (25%)

Information from in-depth interviews about the needs for health application development by the healthcare team:

1. Health problems: One group from the sample mentioned that patients cannot control their swelling conditions. They want patients to have knowledge and understanding of the disease condition and to practice proper behavior. For example,

Example 1: "The problem is that patients who frequently visit hospitals mostly cannot control their swelling because they do not know how much water to drink or restrict."

Example 2: "Patients often come to the hospital with swelling because they cannot remember and understand all the information nurses provide about the disease."

2.Self-management challenges: One group from the sample mentioned that they want patients to be able to self-manage without needing to come to the hospital. For example,

Example 1: "It would be great if patients could manage themselves at home, such as restricting salt intake and monitoring their swelling symptoms effectively. This would reduce problems and treatment costs."

Example 2: "I want patients to be able to take their medications, limit their water intake, and effectively observe their swelling symptoms at home. This would improve patients' quality of life and reduce financial burdens on families."

3.Health management needs: One group from the sample mentioned that if an application could help patients improve their health, it would make the healthcare team's job easier. For example,

Example 1: "It would be great to have a personal health assistant to take care of patients at home, as it would make patients more comfortable, reduce workload and family and government expenses."

Example 2: "If there is technology to support patients and their relatives in self-care at home, it would be beneficial, but it should be suitable for the economic status and abilities of the patients."

4. Monitoring and notification: One group from the sample mentioned that there should be notifications and advance appointment scheduling, along with patient identification. For example,

Example 1: "Some patients do not come for appointments because they forget, resulting in worsening symptoms and prolonged hospital stays."

Example 2: "Many patients either come early or late for their appointments because they remember the wrong date. Those who come early might not be prioritized, while those who come late find out their medications are out of stock, worsening their condition."

5. Access to information and knowledge: One group from the sample mentioned that knowledge should be accessible through the application and able to address patient problems. For example,

Example 1: "Many patients like to seek knowledge and disease care through current social media platforms like Line or TikTok, but these are not standardized. Therefore, it would be good if we could provide information in video format, but it should meet certain standards."

Example 2: "If the application can effectively provide knowledge and solve patient problems, it should be feasible. From what I've seen, most patients have smartphones, except for some very elderly patients with hearing and vision problems, who are taken care of by their grandchildren. Therefore, the media should be easy to understand and usable by patients' relatives."

6. User convenience: One group from the sample mentioned that the application should work under both Android and iOS operating systems without requiring internet connection. For example,

Example 1: "Everyone has a mobile phone nowadays; it's convenient and easy to use with clear networks across all carriers."

Example 2: "Nowadays, almost everyone, whether children, adults, or the elderly, has a mobile phone. Most elderly people have them to stay in touch with their grandchildren."

7. Support from close relatives: One group from the sample mentioned that patients who cannot use phones should have caregivers available at all times to provide simple guidance. For example,

Example 1: "If we are considering using an application to care for patients at home, we should consider elderly people who cannot use phones on their own. It might be better to allow relatives to use it on behalf of the patient."

Example 2: "Some elderly people have vision problems and cannot read books, but most of them stay with their grandchildren. We should educate caregivers to better care for the elderly rather than relying on the elderly themselves."

8. Health promotion needs: One group from the sample mentioned that knowledge should be provided through video clips and text. For example,

Example 1: "Many patients have vision problems, especially the elderly who cannot read books. Some have hearing problems. If we have videos with pictures, sound, and text to read, it could help patients with these problems."

Example 2: "In the past, knowledge was often provided through leaflets handed back home, but it's likely that they weren't read. If there were short, fun, animated videos, it could be more engaging."

9. Components of the application: One group from the sample mentioned that the application components should be user-friendly, such as having readable text, soothing colors, being straightforward, and addressing patient problems.

For example,

Example 1: "The appearance should be easy to see, with large text and simple words that are easy to understand. There shouldn't be too many questions; that would be good."

Example 2: "Bright, clear colors that are easy to see and use, organized into categories, should make it easier for patients to use."

10. Development considerations for the application: One group from the sample mentioned that the application should be widely usable among all patient groups. For example,

Example 1: "It would be great if the application could be used widely by all patients."

Example 2: "If the application works well, I would like it to be used with heart failure patients in many areas."

Needs for heart failure patients:

1. Health problems: One group from the sample mentioned that they cannot decide on their own medication adjustments, eat improperly, easily get tired, do not know the amount of water consumed each day, and do not rest or exercise appropriately, and refrain from inappropriate activities. For

example,

Example 1: "When symptoms occur, I don't dare to come to see a doctor, wait for an appointment, because I don't know if I can make an appointment on my own or wait for better days."

Example 2: "I don't know if I can make an appointment on my own, I don't know if I can make an appointment on my own, and I don't know if I can make an appointment on my own."

2. Self-management challenges: One group from the sample mentioned that they want to take care of themselves better than this, do not want to go to the hospital often, and when there is swelling, they can take care of themselves. For example,

Example 1: "The most difficult thing is to restrict water, because the weather is hot and I am tired. The more I drink, the more I drink."

Example 2: "Sometimes I know when to start swelling, but I don't know what level of swelling it should be. I take medicine as prescribed by the doctor. I still have swelling until I have to go to bed in the hospital. "

3. Health Management Needs: One group suggests that if the app can assess and assist in daily decision-making, it would improve quality of life. For instance, reminders to measure blood pressure, take medications, adjust dosages, and stay hydrated would be beneficial. For example:

Example 1: "If there's technology to help, I'd like it to monitor blood pressure, remind me to take medications, and on doctor's appointment days, tell me how much water to drink."

Example 2: "If a doctor app could assist, calculating hydration needs and advising if I should see a doctor, and notifying about swelling levels and their severity would be great."

4. Monitoring and notifications: Some participants emphasize the need for reminders, scheduling appointments in advance, and alerts for missed medication, with an emergency button in case of life-threatening situations. For example:

Example 1: "I tend to forget. It would be helpful if the

app reminded me of medication times and doctor appointments."

Example 2: "Living alone, having an emergency button would be great. Press it, and someone comes to take me to the hospital."

5. Access to information and knowledge: Participants suggest the app should include educational video clips on proper dietary choices, exercises suitable for their conditions, basic health practices to avoid illness, and 24/7 access to health teams. For example:

Example 1: "It would be excellent to have workout videos tailored to people like me and visuals or videos that tell me what foods are okay or not."

Example 2: "I'm lazy with reading. Short videos with voiceovers on limiting salt intake would be helpful."

6. User convenience: Some participants prefer large, clear fonts with vivid colors and sound effects for ease of use. For example:

Example 1: "I'm elderly and my vision isn't great. I'd like big, clear text or even spoken instructions. That would be easy."

Example 2: "Bright colors and lots of pictures instead of text. Easier to understand than reading."

6. Support from close ones: Participants feel that patients unable to care for themselves should receive assistance from family members in using the app. For example:

Example 1: "My grandmother only answers calls on her phone. Can someone else use it for her? She can't really understand what buttons to press."

Example 2: "My uncle's daughter takes care of him at home. Can she use it instead? He doesn't understand much, and pressing buttons is like a mirror to him."

7. Health promotion needs: Some participants want the app to manage their health, improve their quality of life, and offer guidance and assessments, such as estimating their health risks, making decisions about hospital visits, and providing direct hospital contact numbers in emergencies. For example:

Example 1: "If possible, I'd like the app to tell me my condition severity, whether I need to go to the hospital, and have a direct hospital contact number."

Example 2: "If an app could help me decide how to care for myself today, like how much water to drink or if I can have salt, that would be good. Should I go to the hospital for my current symptoms or not?"

Discussion of Findings

Patients with heart failure experience difficulties in daily life, decision-making, and psychological stress, leading to a reduced quality of life and a need for close caregiving. Therefore, if patients have tools to assist in decision-making, provide knowledge, and guide correct behaviors, it can improve their quality of life and lessen the burden on caregivers. Based on patient interviews, researchers developed a self-management system for heart failure patients using health apps, with the following prototype features:

1. **Medication and hydration control:** The app can regulate the amount of medication and water intake required daily, based on the individual's current physical condition.
2. **Decision support:** The app helps patients make informed decisions about self-care activities based on the level of risk present at that time.
3. **Direct communication with health teams**: Patients can directly communicate with healthcare teams through the app to assist in decision-making at another level.
4. **Preparedness and emergency response:** Healthcare teams can prepare patients before hospital visits and/or respond to emergencies by receiving patients from home.
5. **Sample app** Designed for Heart Failure Patients and Healthcare Teams: A prototype app tailored to the needs of heart failure patients and healthcare teams.

Research outcomes

The study achieved the following results according to the research objectives:

Objective 1: To develop a self-management system

model for heart failure patients using a health application.

1. The prototype health application for the self-management of heart failure patients includes the following features:
2. The application allows for the control of medication and water intake based on the patient's daily physical condition.
3. It helps patients make informed decisions regarding their actions based on their current risk level.
4. The application provides direct communication with healthcare teams to aid in decision-making.
5. Healthcare teams can prepare for patient visits or arrange home pick-ups in emergency situations.
6. The prototype application is designed to meet the needs of heart failure patients and healthcare teams.

Implications

The application can be used by heart failure patients for self-management to reduce symptoms or preventable complications at home.

1. Heart failure patients experience an improved quality of life.
2. The burden on healthcare professionals is reduced.

References

1. Ministry of Public Health. Statistics on Non-Communicable Diseases (NCDs). Bangkok, Thailand: Ministry of Public Health; 2020. Accessed September 28, 2025. https://ddc.moph.go.th/uploads/publish/1035820201005073556.pdf

2. Siridam U, Deekudon T, Poonchai S. Developing a self-management model for patients with heart failure at the Heart Failure Clinic, Sakon Nakhon Hospital. 2020.

3. Athilingam P, Jenkins B. Mobile phone apps to support heart failure self-care management: integrative review. JMIR Cardio. 2018;2(1):e10057. doi:10.2196/10057

4. Lippi G, Sanchis-Gomar F. Global epidemiology and future trends of heart failure. AME Med J. 2020;5:15. doi:10.21037/amj.2020.03.03

5. Poungkaew A, Boontein P, Tongsai S, Charoenyos N, Tanutpokeenun L. Factors predicting quality of life among patients with heart failure. Thai J Cardio-Thorac Nurs. 2020;31(1):179-197.

6. Ralapanawa U, Sivakanesan R. Epidemiology and the magnitude of coronary artery disease and acute coronary syndrome: a narrative review. J Epidemiol Glob Health. 2021;11(2):169-175. doi:10.2991/jegh.k.201203.001Promwong W, Meenongwah J. Fluid self-management in heart failure patients. Vajira Med J Urban Med. 2019;63(4):297-304.

7. Promwong W, Meenongwah J. Fluid self-management in heart failure patients. Vajira Med J Urban Med. 2019;63(4):297-304.

8. Fatima, T., Bilal, A. R., Imran, M. K., & Jam, F. A. (2025). Developing entrepreneurial orientation: Comprehensive skill development guide for software industry in

South Asia. In Entrepreneurship in the Creative Industries (pp. 132-157). Routledge.

9. Jam, F.A., Khan, T.I., Zaidi, B., & Muzaffar, S.M. (2011). Political Skills Moderates the Relationship between Perception of Organizational Politics and Job Outcomes.

Appendices

An application designed according to the needs of patients with heart failure and healthcare teams

Figure 1. Baseline body weight and diuretic dose (entered by researcher) screen shots
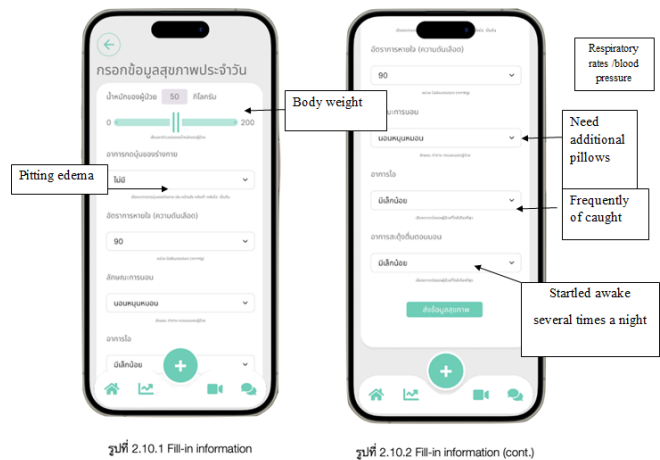

Figure 2. Application dashboard

รูปที่ 2.10.1 Fill-in information   รูปที่ 2.10.2 Fill-in information (cont.)

Figure 3. Main menu screen shot of HFAA for users.

รูปที่ 2.10.3 Result of data processing   รูปที่ 2.10.4 Result of data processing (cont.)
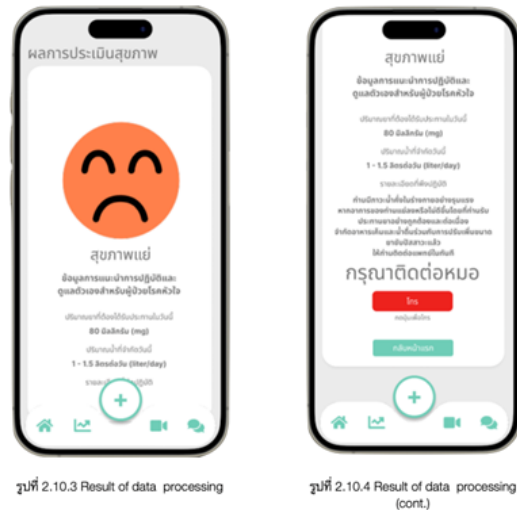
Figure 4. Result of HFAA for users

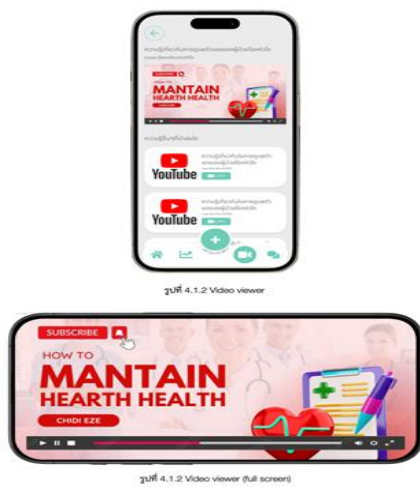**Figure 5.** Report graph and calendar

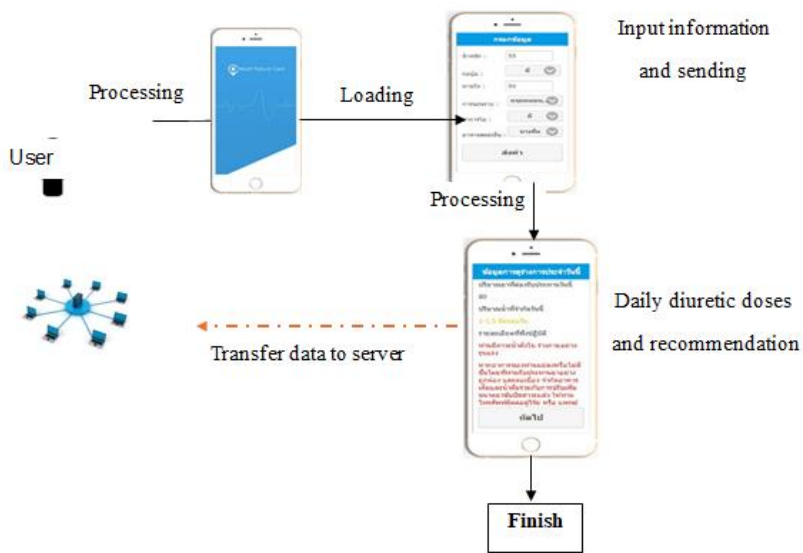**Figure 5.** Video about Heart Failure Knowledge

Figure 5. Contacts list (ready to call)

Figure 6. Elements of a HFAA.