


Development of a Home-Based Nursing Intervention Model for Patients With Heart Failure: A Qualitative Feasibility Study

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Abstract

Aim: To develop and verify the feasibility of a personalized home-based heart failure (HF) nursing intervention model to support HF patients, promote self-management, and avoid HF exacerbation and re-hospitalization. **Methods:** Based on processes established in previous studies, literature reviews, and evidence-based guidelines and theories, we developed the nursing intervention model for patients with HF. The goal of this model is to harmonize symptom deterioration prevention behavior and individual lifestyle. After intervention, we conducted semi-structured interviews with participants, and data were transcribed verbatim, after which qualitative content analysis was employed. The contents of visiting nursing practice, opinions on this nursing model, and self-management in patients with HF were analyzed qualitatively and inductively from the viewpoint of practicality and acceptability. **Results:** Five nurses who provided interventions, as well as five patients with HF, participated in this study. Accordingly, our findings showed that the framework, assessment, and nursing intervention contents of this model can be practical for everyday home nursing visitations. **Conclusions:** The content has been revised so that more visiting nurses can use them, including those who have less cardiovascular nursing experience.

Keywords

heart failure, self-management, qualitative study, feasibility study, home-based care, nursing

What do we already know about this topic?

Nursing intervention in self-management for patients with heart failure improve patient's outcome such as emergency department visits and unplanned readmissions. Most of these studies are conducted by cardiovascular nurses. Only a few are performed by home care providers.

How does your research contribute to the field?

It is important that nurses need to have the viewpoint of the balance between preventing decompensation and patient preferences.

What are your research's implications towards theory, practice, or policy?

Our nursing model can be used as reference by visiting nurses who have little experience in cardiovascular care and general duty nurses, and may promote self-management of patients with HF.

Introduction

Heart failure (HF) is prevalent among approximately 1–2% of the adult population in developed countries, rising to $\geq 10\%$ among those over 70 years of age.¹ Approximately 260000 Japanese patients are annually hospitalized for HF, the nation's second leading cause of death, with such a figure increasing at a rate of 10000 per year.² Previous nursing intervention studies have shown that nursing intervention

reduced emergency department visits and unplanned readmissions while lowered healthcare costs and improved

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psychological status.³⁻⁵ Although most nursing interventions or disease management programs are provided based on guidelines, limited studies regarding intervention components and implementation methods have been available.⁶ Therefore, Pinchera et al. proposed that optimal intervention strategies should be individualized to suit the patients' chronic condition and included in multicomponent and eHealth interventions.^{6,7} However, Jonkman et al.⁸ stated that self-management interventions show great diversity in terms of mode, content, intensity, and duration. On the other hand, patients with HF receive ambiguous advice, display inconsistent behavior and symptoms, are impacted by socioeconomic factors, have poor adherence, become disappointed due to failure despite practice, have physical and psychosocial restrictions due to HF, and poor psychological response to restrictions from medical professionals, all of which leads to worsening of symptoms.⁹ Despite numerous intervention trials and disease management programs having been implemented to prevent readmission and reduce mortality, only a few are performed by home care providers (HCPs).^{10,11} A study that surveyed the knowledge of community nurses revealed that they had basic understanding of HF but scored poorly on weight assessment, blood pressure management, and reporting to physicians of dizziness.¹² Therefore, providing viewpoints for HF management to HCPs having less experience with cardiovascular nursing, which will improve patient's outcomes and quality of HF management in home care settings, is meaningful. In addition, there are no previous studies aimed at harmonizing self-management practices and lifestyles of patients with HF. This study provides new insights into self-management programs for patients with HF.

The present study aimed to verify feasibility of a personalized home-based HF nursing intervention model to support patients with HF, promote self-management, and avoid exacerbation of HF and re-hospitalization.

Descriptions of the Nursing Intervention Model for Patients With Heart Failure

We described the nursing model according to the template for intervention description and replication (TIDieR) checklist and guide.¹³

Brief Name: Provide the Name or a Phrase That Describes the Intervention

This model was administered to HF patients by home-visiting nurses. Having a home-based nurse helped balance their self-management practices and lifestyle.

Why: Describe Any Rationale, Theory, or Goal of the Elements Essential to the Intervention

This model was developed based on the methodology proposed by Aranda¹⁴ who suggested a stepwise development

process focused especially on complex nursing intervention development, as well as patient-centered nursing care and the structure and delivery of interventions.

The draft version of the framework and interventions described was based on the self-management process from a recent study,¹⁵ the Middle-Range theory of self-care for chronic HF,¹⁶ and current recommended clinical practice guidelines.¹⁷ The self-management process is an approach to living life that prevents worsening of symptoms while balancing good choices and preferences. Through trial and error, patients with HF attempt to determine the limits of physical capacity and dietary choices that would promote worsening of symptoms while also trying to maintain as much quality of life as possible.¹⁵ The Middle-Range theory provides an intervention structure for self-care improvement that can be applied to practice.¹⁶ This theory suggests three steps for self-care, namely, (1) self-care maintenance, (2) self-care monitoring, and (3) self-care management. Finally, the components of self-management and goals of this model were identified. Accordingly, the components of self-management include "Experience and knowledge about HF," "Self-monitoring and Early perception," and "Life coordination for HF and living meaningfully." Meanwhile, this model aimed to achieve "Balance between preventing decompensation and preferences."

What (Materials): Describe Any Physical or Informational Materials Used in the Intervention, Including Those Provided to Participants or Used in Intervention Delivery

Home-visiting nurses caring for HF patients in their homes referred to a booklet describing observation and assessment viewpoints. The frequency of visits was approximately once or twice per week, as directed by a physician. In addition, we developed a non-invasive tele-monitoring (TM) tool. This internet-based tool enables sharing of patient data such as body weight, blood pressure, heart rate, and signs and symptoms of HF with patients and health care providers, such as nurses and physicians. The patients were instructed on how to use the HF self-management tool and were informed that they could browse for information on the internet, and use the tablet device for continuous self-monitoring, and take actions based on monitoring results for the purpose of early consultation and to prevent exacerbation.

What (Procedures): Describe Each of the Procedures, Activities, and/or Processes Used in the Intervention, Including Any Enabling or Support Activities

Visiting nurses performed observations, assessments, and consultations using the nursing model. They could view graphs and tables of patient data via a dedicated website. Thus, they could assess the patient's condition without in-person visits, while still being able to contact them if there were any concerning signs or symptoms.

Who Provided

The intervention was delivered by visiting nurses. Before study initiation, the researcher explained the outline and practice methods of the nursing model to the visiting nurses.

How

The intervention was delivered face to face by a visiting nurse. This nursing model focuses on nursing support for each self-management component and promotes self-management in patients with HF based on individual goals and intentions. Accordingly, nursing practice methods that promote balance between preventing decompensation and patient preferences are presented below.

- (1) Understanding the patient's goals and life values
- (2) Assessing the focus of nursing support to determine which self-management component needs nursing support to achieve established goals
- (3) Practicing nursing support according to assessment findings
- (4) Confirming the response of patients with HF after nursing practice
- (5) Providing feedback of confirmed contents to the patients and repeating assessment and nursing support

HF symptoms and exercise tolerance may change over time due to clinical characteristics of HF. In response to such changes,

patients need to modify their lifestyle, goals, and intentions accordingly. Thus, consistently understanding, providing feedback to, and repeatedly assessing the patients' goals and intentions is imperative. Figure 1 presents a draft version of the nursing intervention model supporting self-management for patients with HF.

As the visiting nurses were able to see the patient's data via the dedicated website, they could contact patients through phone calls or additional visits, as needed.

Where

The intervention was delivered in patients' homes.

When

Intervention sessions were held for 30–60 min, once or twice per week.

Tailoring

Although home visitations aimed to manage HF, nursing interventions for co-morbid conditions and nursing support in accordance with the contents of home-visiting nursing instructions not included in this nursing model must still be provided during visitations. Therefore, the researcher explained that this nursing model should be used as a reference as long as it does not interfere with usual home-visit nursing care.

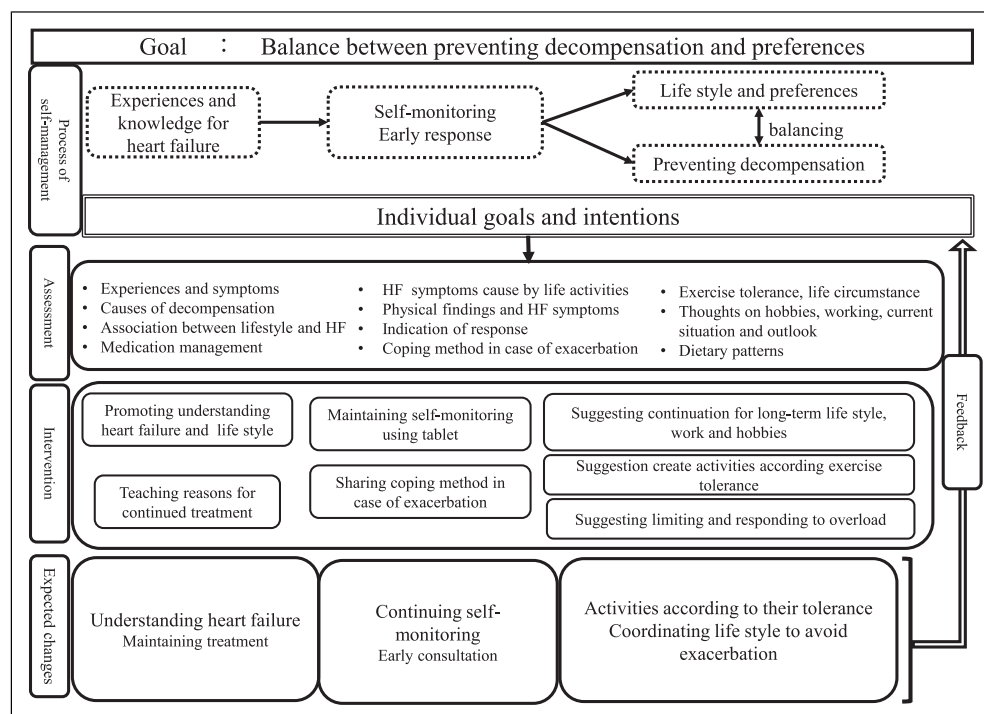


Figure 1. Draft version of nursing intervention model supporting self-management for patients with heart failure.

Table 1. Characteristics of Nurses (n = 5).

ID	Gender	Age (years)	Experience in cardiovascular care
N1	F	42	0
N2	F	37	0
N3	F	41	10
N4	F	30	0
N5	M	26	6

Methods

Design

As recommended by Richards et al., a feasibility study can determine the practicability of performing complex interventions,¹⁸ which can be evaluated using face-to-face interviews, participation status, and adherence. Moreover, intervention feasibility can be evaluated from the viewpoint of the nursing model, intervention provider, and patient. The current study used a qualitative method to evaluate practicality and acceptability of the proposed nursing model. This design was chosen to guide feasibility objectives for a future pilot trial.

Participants

Regarding the sample size for feasibility testing, Morris and colleagues proposed that research objectives should consider sample size and stated that less than 10 participants is sufficient to evaluate the acceptability, process, and practicality of the research.¹⁹ As such, the current study planned to include a minimum of 10 participants. Given our purpose of evaluating the feasibility of the nursing model from the perspective of both nurses and patients, both home-visiting nurses and patients with HF were recruited.

Recruitment

A purposive sampling was selected to ensure variation in the intention of using the nursing intervention model for supporting self-management in patients with HF. Participants were recruited by cardiologists in an academic tertiary hospital located in Japan. Nurses involved in home visitations were invited to participate in patient recruitment, interventions, and qualitative semi-structured interviews post-intervention. They

identified and approached eligible patients, provided study information, and obtained their contact information through which the researcher can contact them.

The inclusion criteria for patients with HF were as follows: age of 18 years or more; ability to speak Japanese, communicate orally, and to use a tablet device; no pre-existing cognitive impairment or psychological illness; and not terminally ill or receiving end-of-life care.

Practicality and Acceptability

The current study evaluated feasibility from the viewpoint of practicality and acceptability. Accordingly, practicality may be determined through the content of visiting nursing practice given that nursing practice may include important content that is not included in the nursing model. Practicality may also be determined by confirming whether nursing practice using a nursing model impacts self-management in patients with HF.

Acceptability can be determined through opinions regarding this model from nurses and patients with HF, which included information regarding what was helpful and not helpful, as well as suggestions for improvement.

Data Collection

Qualitative data were collected by conducting individual semi-structured interviews. Face-to-face interviews were audio-recorded and transcribed. Visiting nurses and patients with HF were interviewed poststudy by the researcher to determine their experiences with HF management using this model, as well as the opinions on the model. The poststudy interviews lasted approximately 30–60 min.

Data Analysis

Transcripts regarding practicality were analyzed using qualitative content analysis following the steps outlined by Graneheim and Lundman.²⁰ The analytical process included the following steps: (1) each transcript was read, after which feasibility descriptions from the text were extracted in meaning units; (2) meaning units were used to shorten the sentence into simple phrases and create a code so that the meaning is not lost; (3) similar codes were grouped and sub-categories were created; and (4) sub-categories with similar content were collected and structured into categories.

Table 2. Characteristics of Patients (n = 5).

ID	Gender	Age (years)	Size of household	NYHA	LVEF (%)	Experience with tablet devices
P1	F	65	3	II	29.4	Yes
P2	M	72	2	III	42.0	Yes
P3	M	80	2	III	40.0	No
P4	F	76	4	III	45.0	No
P5	M	68	2	IV	28.2	Yes

NYHA, New York Heart Association; LVEF, left ventricular ejection fraction.

Table 3. Practicality From the Nurses' Perspective.

Relevance components of the nursing model	Category	Sub-category
None	Nursing practice according to visiting nursing assignment	<ul style="list-style-type: none"> ● Deliver home nursing care according to instructions ● Confirm indicators prompting physician contact
Assessment	Observing the patient's lifestyle and livelihood	<ul style="list-style-type: none"> ● Support the patients' life sly while following nursing instructions ● Take on the attitude of an escort runner
Assessment	Identifying the patient's values, goals, and circumstances	<ul style="list-style-type: none"> ● Confirm the social role to which patients assign great value ● Understand individual goals, activities, and enjoyment ● Listen to individual goals and thoughts ● Listen to individual future thoughts ● Bring out individual perception from the conversation ● Understand the difference in perception between nurses and patients ● Grasp individual sphere of action
Intervention	Respecting the individual's will even for activities and habits that burden the heart	<ul style="list-style-type: none"> ● Prevent overloading caused by fulfilling social roles ● Respect the individual's purpose in life, even when it places unwanted stress on the heart ● Use an additional diuretic to allow patients to spend more time than their limit ● Given that excessive restriction leads to stress, care should be taken not to cause acute exacerbation ● Encourage eating without restriction when decreasing food intake or weight
Assessment	Observing and understanding appropriate dietary habits and cause of deterioration	<ul style="list-style-type: none"> ● Determine specific salt intake in collaboration with a registered dietitian ● Promote understanding of the lifestyle-related causes of heart failure exacerbation ● Remind patients to be careful with their diet ● Make sure patients have consume low-salt foods ● Assess daily dietary habits ● Understand overloading circumstances in the individual's life ● Check for any exacerbations based on physical symptoms after activity
Assessment	Identifying causes of exacerbation or physical changes	<ul style="list-style-type: none"> ● Pay attention to deterioration associated with weight and blood pressure changes ● When changes occur, confirm the likely episode with the family member and investigate the factors ● Understand dietary habits that lead to weight gain
Assessment	Observing the patient's condition via the application	<ul style="list-style-type: none"> ● Assess the patient's condition on the application regularly ● Assess the frequency of changes according to patients' conditions
Intervention	Irregular contact when needed	<ul style="list-style-type: none"> ● Call when something is wrong with the application ● Although the application shows signs of deterioration, nurses need to show patience when it does not persist
Intervention	Continuously encouraging self-monitoring	<ul style="list-style-type: none"> ● Assess the application contents with the patients and their family when visiting ● Inform the patients that the application is checked regularly
Intervention	Caregiving within exercise tolerance and suggested balance between activity and rest	<ul style="list-style-type: none"> ● Determine the amount of exercise suitable for the patient ● Provide personal hygiene care that suits the individual exercise tolerance ● Ensure balance between activity and rest as advised ● Inform patients to rest during activities

(continued)

Table 3. (continued)

Relevance components of the nursing model	Category	Sub-category
Intervention	Propose concrete suggestions considering the patient's capabilities	<ul style="list-style-type: none"> ● Occasionally warn against stress so that lifestyle habits are not restored ● Suggest concrete ways of preventing excess sodium intake to family members ● Propose alternatives according to the patient's condition ● Assess the degree of shortness of breath and propose activities that individuals are likely to do ● To encourage eating out, explain reasons and possible range to reduce anxiety ● Communicate guidelines without denying that the patient is careful ● Provide specific feedback on what has been done so that it can be continued
Intervention	Sharing practical methods for managing exacerbations or emergencies	<ul style="list-style-type: none"> ● Communicate specifically what needs to be discussed ● Communicate about responses at the time of abnormality during each visit ● Communicate specific procedures, such as contact information, location, and person to contact in case of emergency ● Consider indicators that can be commonly recognized in patients and their family members
Intervention	Building a cooperation system and collaborating with other medical staff for prompt action	<ul style="list-style-type: none"> ● Build a collaborative system with doctors for emergency situations ● A trusting relationship with the attending physician promotes prompt response

Transcripts regarding acceptability were coded according to each theme. The research team reviewed and discussed until consensus was reached.

Ethical Considerations

This research was conducted based on the principles of the Declaration of Helsinki and the Japanese Ethical Guidelines for Medical and Health Research involving Human Subjects. The research was approved by the Chiba university ethics review board (No: 30-81). Using the consent form as reference, the aim, procedures, and potential risk and benefits were explained to each eligible patient. Confidentiality and anonymity were assured; queries were answered before informed consent was finalized. All data were kept in a secure location; the data set was maintained in a password protected digital device.

Results

Participant Characteristics

Five visiting nurses and five patients with HF participated in this study. Among the visiting nurses (average nursing experience, 15.4 years), four were female, while three had no experience in cardiovascular nursing. Among the patients with HF, three were male. Moreover, all patients had low left ventricular ejection fraction and were living with their families.

Tables 1 and 2 summarize the characteristics of the nurses and patients with HF, respectively.

Practicality

Nursing Practice Using the Nursing Model. All nurses who participated in this study referred to the contents of this model. In particular, the web-based self-management tool was used both at the office and the patient's home. Given that this tool provides daily information, such as patient weight, blood pressure, and subjective symptoms, nurses were able to prepare for the assessment and determine what to ask the patient before visiting the patient's home and during irregular contact when needed. Moreover, they focused on the patient's living environment and lifestyle when assessing for factors that could lead to exacerbation of HF rather than confirming the self-management process step by step. Furthermore, they provided information regarding exercise tolerance to the patient, suggested balance between activity and rest, and proposed concrete suggestions within patient's capability. Nurses indirectly established a collaborative system for emergencies and relationships with other medical staff to facilitate rapid response. Table 3 presents the nurses' perspectives on the relevance and practicality of the nursing model components.

Self-Management in Patients With Heart Failure. By applying the current model, patients who participated herein were able

Table 4. Practicality from the patients' perspective.

Category	Sub-category
Habituation of self-care	<ul style="list-style-type: none"> ● Habitual recording leads to regular action ● Consciously using the application because nurses also refer to it
Acquisition of knowledge from nurses	<ul style="list-style-type: none"> ● Consult when diuretics do not work ● Ask a visiting nurse when they have questions ● Obtaining advice on measurements is helpful
Refer to symptom changes or medical contact rather than the recommended comments in the application	<ul style="list-style-type: none"> ● Contacting nurses following application feedback is annoying ● Visiting nurses will contact when something is wrong. As such, if the condition does not change the next day, patients don't respond to application feedback ● Application feedback is no cause for worry as there is no change in subjective symptoms
Leave decisions regarding symptom exacerbation to others	<ul style="list-style-type: none"> ● In case of exacerbation, contact emergency services or the 24-h home-visit nursing services ● Leave emergency response to visiting nurses ● Family members determine signs of deterioration ● Leave the determination of swelling to the visiting nurse
Perceive signs of heart failure in daily life	<ul style="list-style-type: none"> ● Awareness of heart failure exacerbation from symptom changes during bed rest ● Perceive worsening of heart failure with the onset of shortness of breath and rest immediately ● Notice changes in shortness of breath with weight gain ● Perceive bodily sensations through weight changes ● Recognizing chest discomfort as heart failure exacerbation based on previous experience
Adjustment of medication dosage according to condition	<ul style="list-style-type: none"> ● Use diuretics and vasodilators according to symptoms ● Take additional diuretics when gaining weight
Add rest according to heart failure symptoms	<ul style="list-style-type: none"> ● Rest consciously when edema worsens ● Rest consciously when respiratory symptoms worsen
Methods of preventing overload	<ul style="list-style-type: none"> ● Rest consciously the day following several activities ● Try to rest after heavy activity ● After changing clothes or taking a shower, rest and let the symptoms resolve ● Start bathing from the lower body to avoid being overloaded, and keep bathing short ● Avoid carrying heavy objects, and walk slowly to avoid overloading
Modifying dietary habits and activity level based on examination results and own condition	<ul style="list-style-type: none"> ● Reduce snacking when gaining weight ● Be careful of own dietary habits when signs of deterioration appear on examination ● If exacerbation occurs, be careful with fluid intake ● When taking a walk, listening to your own body ● Control rehabilitation according to the degree of shortness of breath ● Discern the effects of rehabilitation from the degree of shortness of breath during activity

to acquire self-care habits. One of the reasons is their understanding that nurses were referring to the application contents. Moreover, they consulted with the nurses when diuretics did not work or when they had any questions and acquired knowledge regarding HF from the nurses. However, they still referred to their symptom changes or medical contact rather than to the recommended comments from the application. Additionally, they left decisions regarding symptom exacerbation to others. On the other hand, patients were able to perceive signs of HF in daily life, add rest periods according to HF symptoms, and adjusted medication dosage according to their conditions. Moreover, they modified their dietary habits

and activity level based on examination results, advice from nurses, and their condition. [Table 4](#) presents practicality from the patient's perspectives.

Acceptability

Visiting Nurses' Perspective. Nurses who participated in this study provided their opinions regarding the nursing model framework, contents of assessment and intervention, evaluation methods, and utilization and application.

Extract

About the framework

Table 5. Opinions on nursing model.

Nurses	
Nursing model framework	<ul style="list-style-type: none"> ● observe the patient's life and then determine at the process elements in the model ● This process can be reversed ● First, directly observe the patients' life, such as meals and living environment ● Relationships centered on the patients' thoughts and hopes are important ● Knowing the elements of self-management is necessary to determine top priorities ● Although process arrows have room for consideration, the elements are important
Assessment and intervention contents	<ul style="list-style-type: none"> ● Determine what to do with a certain thing rather than targeting the problem observed in the living environment ● Understand the direction of support by knowing that patients lack consciousness of their disease ● Assessing information regarding dietary habits is important ● Modifying long-term lifestyle is difficult ● Collecting social information, such as cohabitants and roles, is necessary ● Support the provision of social resources by assessing living environment ● Request a dietitian for dietary recommendations and trends
Evaluation methods	<ul style="list-style-type: none"> ● The wording "expected change" is good ● Continuous support is important ● Ensure that nothing has changed, and reassure the patient ● Confirm patient changes habitually ● Ask each time to repeat what you have said
Utilization and application	<ul style="list-style-type: none"> ● Even those with limited experience with cardiovascular nursing can take a quick look and understand it ● Using a model will help nurses learn and improve their skills ● Training is required to actually assess heart failure symptoms and perform nursing ● Monitoring enables early response ● Obtaining a week's worth of information before visiting allows us to spend less time on assessments and focus on other things ● Given that we can prepare for possible patients responses in advance, interventions can be performed efficiently ● The ability to measure urine and weight daily is good ● The ability to understand the usual condition is convenient ● Applicable patients are limited
Patients	
Suggestions for improvements	<ul style="list-style-type: none"> ● Identifying specific precautions for daily life would be better than a guideline for consultation ● A bulletin board format is required to have a remarks column for information sharing and contact ● The ability to input meals, activities, and fatigue, etc. Would be good ● The ability to freely input their concerns or interests would be good ● A graph display that shows small changes would be good
Positive comments	<ul style="list-style-type: none"> ● Operating the tablet is not difficult ● Inputting data on the app every day is not a burden ● Positive feedback can provide peace of mind ● A display showing "doing well" can evoke happiness ● Being followed up by health care providers promotes a sense of safety

"I look at the patient's life, following look at the process elements in the model. Then this process is important but can be the opposite." (N1)

"It is necessary to know the elements of self-management in order to bring out the top priorities." (N3)

About the assessment and intervention contents and evaluation methods

"I have an idea of what to do with a certain thing rather than targeting the problem of the grasped living environment." (N2)

"It is necessary to collect social information such as cohabitants and roles." (N5)

"In fact, make sure that nothing has changed and reassure each other. And it is important to continue to explain and check." (N4)

Patients' Perspective. Patients with HF who participated in this study primarily reported about suggestions for improvements of the application or positive comments.

Extract

"There is no difficulty in operating the tablet. And the action of inputting app every day is not a burden." (P2)

"It is better to show specific precautions for daily life rather than a guideline for consultation." (P4)

"I have sense of safety seen by health providers." (P1)

"A bulletin board format is required to have a remarks column for information sharing and contact" (P3)

"I got peace of mind with positive feedback, then be happy if it is displayed doing well" (P4)

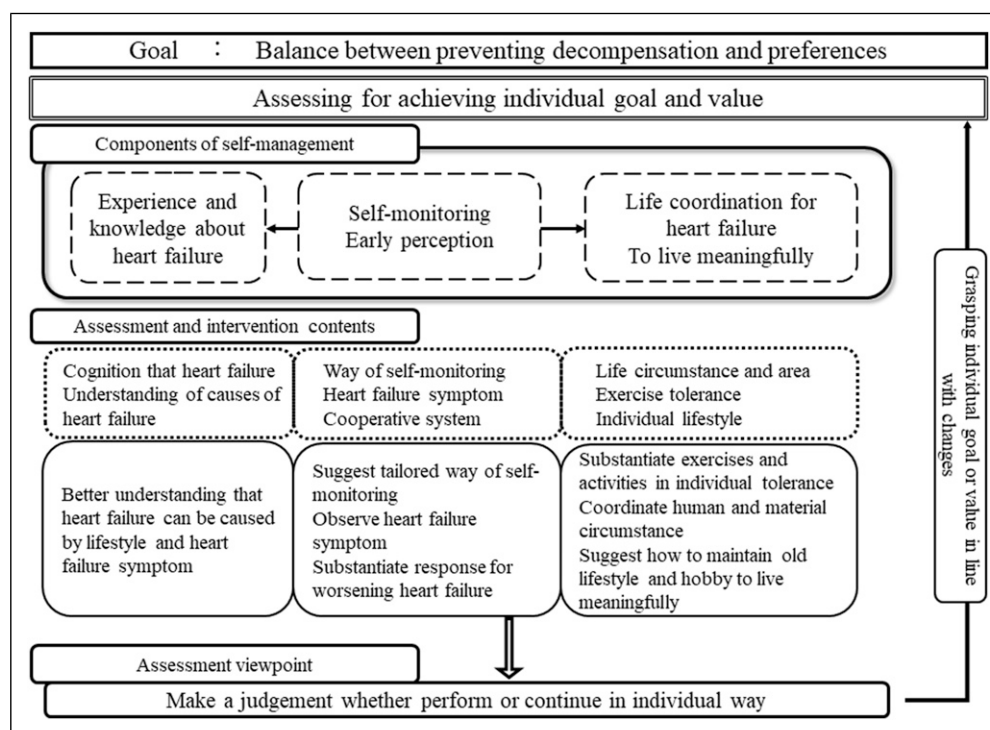


Figure 2. Nursing intervention model supporting self-management for patients with heart failure.

Table 5 presents acceptability from both nurses' and patients' perspectives.

Discussion

The current study aimed to evaluate the feasibility of our nursing model from the viewpoint of practicability and acceptability and determine whether this nursing model can be utilized by visiting nurses to promote self-management among patients with HF. Moreover, the nursing model was modified based on the current feasibility evaluation.

Targeted visiting nurses included herein had an average nursing experience of 15.4 years (range, 6 to 21 years), with the average experience for visiting and cardiovascular nursing being 4.2 years (range, 1 to 10 years) and 3.2 years (range, 0 to 10 years), respectively. Moreover, the patients with HF included herein were in their late 60s to early 80s, had no apparent difference in New York Heart Association classification (II to IV), and had a range of living that allowed them to perform activities ranging from going shopping by themselves to spending most of their time at home. Moreover, approximately half of them had experience with the use of a tablet computer. Both visiting nurses and patients with HF had a wide range for age, experience, and severity and were evaluated using the various perspectives of this nursing model. As such, no considerable bias in the subjects can be noted.

Revising the Nursing Model

Due to the medical system in Japan, visiting nursing assignments are provided by the physicians, after which home-

visiting nursing services can be initiated. Overall, our analysis showed that each element included in the nursing model had been practiced. Accordingly, nurses were able to respect the patient's lifestyle and values while considering the visiting nursing interventions, an aspect unique to this study. Furthermore, we determined that the self-management is a two-way process that involves a back-and-forth between nurses and patients. One study employing a patient-centered program focusing on energy conservation for patients with HF described that a specialized program enhanced patient's knowledge and valuable strategies.²¹ The current study also echoed similar results, showing that balance between preventing decompensation and patient preferences is practical in home care settings.

Previous works showed that the impact of the mHealth interventions on self-care and quality of life were inconsistent at best.^{22,23} However, four of the patients included herein had input rates above 90%, suggesting that mHealth interventions may support self-care continuation of patients with HF. Moreover, nurses included herein utilized mHealth interventions to check the patient's conditions and promote self-monitoring for patients with HF. Unfortunately, only a few institutions can utilize mHealth intervention, which is necessary for the practicality of providing nursing support that promotes continuous self-monitoring in home care settings.

Previous studies on best practices for patient self-management identified multidisciplinary/team effort and one-on-one with a health care provider combined with print material or electronic devices as the most frequently used approaches.^{7,24,25} In the current study, participants

built a collaborative system for emergencies and relationships with other medical staffs to enhance response times. Thus, collaboration with other medical staff and using mHealth tools can be considered key aspects of our nursing model.

Nurses included herein repeatedly confirmed whether patients experienced any changes (ie, deterioration in condition) since the previous visit and whether they were able to continue to receive advice and support. Through these actions, they obtained information for other nursing support. Evaluation after nursing support will therefore be performed at each visit and will include identifying changes after nursing support according to assessment, degree of understanding, implementation status, and presence of continuation. This can be expected to provide a more practical and actionable perspective. Based on such results, our model was revised, with Figure 2 showing the revised nursing intervention model.

Limitations

Some limitations of the current study are worth noting. First, participants in this study may not represent the diversity of people with HF and visiting nurses. Most patients in this study are categorized in NYHA III classification and more than half of nurses are no experience in cardiovascular nursing, these may be biased towards moderate which might affect the findings. A number of participants is limited but approximately ten participants can be sufficient this qualitative study.¹⁹ Therefore, we believe that the data in this study give a broad description of the participants' insight of the nursing model. Second, no efficacy data were collected during this feasibility study. Owing to the lack of quantitative outcome assessment and results regarding benefits and disadvantages, quantitative assessment may be needed in the future to assess various effects of nursing interventions.

Conclusion

The current study aimed to develop and verify the feasibility of a home-based HF nursing model aiming to harmonize individual lifestyle and behaviors preventing symptom exacerbation in patients with HF receiving home-visiting nursing care services. Almost all participants were able to benefit from the nursing practice provided by the nurses as per the content specified the model. Therefore, this nursing model had high practicality, and the modifications to the model helped further improve the direction of nursing support for better practicality and acceptability. Our nursing model can be used as reference by visiting nurses who have little experience in cardiovascular care and may promote self-management of patients with HF. Future research is needed to determine the efficacy and effectiveness of interventions using the nursing model.

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Author Contributions

MS and TM designed and conducted this study, carried out data collection, reviewed and revised data for submission. All authors approved the final manuscript for submission.

Declaration of Conflicting Interests

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Appendix I

Interview Guide (English Translation).

For nurses

1. Please tell me how easy it is to understand the nursing model and the entire application (display, composition and contents, etc.), including the booklet
2. Please tell me what was easy or difficult when assessing patients with heart failure and providing nursing support by referring to the nursing intervention model
3. Please tell me how to guide the focus of assessment, contents of nursing interventions, etc
4. Please tell me what you want to add, what you think needs to be modified, and what you think is unnecessary in the contents of the nursing intervention model
5. How often did you check the patients' data and at what timing did you check it? Please let me know if there is any information that you could use it in particular
6. How useful do you think the use of the application will be in actual home visiting nursing?

For patients with HF

1. Have you been accepted or not accepted by the proposal from the visiting nurse?
 2. Has there been a change in life consciousness through nursing support or the use of application?
 3. Have you ever actually changed or wanted to change your daily life with nursing support?
 4. What are the pros and cons of the self-management tool in terms of operation and daily use?
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