

Article

Development of health promotion program for frail older adults based on the intervention mapping

Eun Jeong Nam¹, Jong-Eun Lee², Heechong Baek^{3,*}¹ Department of Nursing, Seoul Women's College of Nursing, Seoul 03617, South Korea² College of Nursing, The Catholic University, Seoul 06649, South Korea³ Red Cross College of Nursing, Chung-Ang University, Seoul 06974, South Korea* **Corresponding author:** Heechong Baek, hcbak@cau.ac.kr

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Abstract: The effectiveness of frailty intervention programs for older adults in Korean communities has been inconsistent, posing challenges for public health nurses (PHNs). This study aims to develop an evidence-based intervention using the Intervention Mapping (IM) Protocol. The program followed the IM Protocol's six steps, which provide a systematic method for developing and implementing theory-based health promotion programs. In Step 1, the needs of the subjects were identified through systematic review and interviews. In Step 3, the theme of the program was established as 'health promotion for frail older adults', and the components and scope were confirmed. The contents of the program included concepts of social support and social networks. In Step 4, after conducting a pilot test, the results were reflected and modifications were made. In Step 6, the evaluation tool was revised, and an effective evaluation plan was established. The final program was designed based on the program and interview results. The pilot test in Step 4 involved a one-group pretest-posttest and focus group interview with 15 pre-frail older adults. The IM Protocol-based health promotion program effectively addressed the needs of the subjects and improved frailty issues.

Keywords: intervention mapping; frail older adult; logic models; theory-based

1. Introduction

As the frail older adult population has dramatically increased across the globe, the proportion of frail older adults is expected to rise rapidly (Cesari et al., 2016). The ratio of frailty varies between countries and regions, yet in Canada, 7.8% to 20.2% experience frailty (Kehler et al., 2017), and it is estimated that 3.5% to 27% of them in the Asia Pacific region experience frailty (Dent et al., 2017). In the case of the frail older adults in Korea, 2.5% to 55.7% turned out to be in the frailty or pre-frail step according to the classification criteria (Baek et al., 2021). Such frailty reduces resilience by increasing vulnerability to adverse outcomes when exposed to stressors (Fried et al., 2021), and hence, it is a very important health issue for the frail older adults with a high incidence of disease.

In particular, the frailty of frail older adults is highly related to fall, hospitalization, disability, and death (Rolfson et al., 2018), and hence, it is a very important emerging risk factor for health care (Nari et al., 2021). Hence, it is necessary to systematically manage frailty along with the disease management of frail older adults, and seek effective intervention methods to help reduce the social cost caused by the frailty (Rizzoli et al., 2013).

For the definition of frailty, various definitions have been used since Fried's initial definition (Nari et al., 2021), which identified physical aspect as a major issue,

but there is no international definition or measurement standard agreed upon (Dent et al., 2016). Fried's frailty focuses on physical frailty such as weakness, slow walking speed, low physical activity, fatigue or exhaustion, and unintentional weight loss (Fried et al., 2001, 2021). In general, studies on frail older adults evaluate the frailty information using the indicators that measure the daily life skills or activity of frail older adults, such as muscular strength (Ikeda, 2016), grip strength (Bohannon, 2019), nutritional state (Kim et al., 2017), and waist circumference (Liao et al., 2018), etc. Furthermore, psychosocial factors (depression, loss of spouse, etc.) and environmental factors (isolation of information, environmental disconnection) are defined as the frailty aggravating factors (Cameron et al., 2013). However, since the concept of frailty may be interpreted in so many different ways, there is no global gold standard (Cesari et al., 2017), and there is no frail older adults program that consistently proves its effectiveness. For this reason, additional research on the terms of content, duration and follow-up period of the frail older adults program is needed (Dedeyne et al., 2017).

In Korea, public health nurses (PHNs) are responsible for conducting home visits to seniors aged 65 or older and individuals in health vulnerable groups. These visits are designed to provide customized health management consultations and education. Additionally, group education is conducted independently on an annual basis with the objective of addressing major health concerns within the region. Given such a situation, Korean PHNs are experiencing a lot of difficulties in planning and operating a frailty improvement program targeting frail older adults of community. The PHNs work at a public health center or a branch clinic of the public health center in various communities, and develop and operate programs whose effectiveness has not been confirmed for the subjects with different health issues in various environments. Hence, in Korea, it is necessary to develop an evidence-based intervention program targeting the frail older adults of community.

Intervention Mapping (IM) is a protocol which presents a method for systematically developing and implementing the theory-based health promotion programs (Bartholomew et al., 2016). It aims to change the behavioral determinants and environmental determinants related to the subjects' health by reflecting the needs of the entire community. The IM does not simply ask nurses and stakeholders of the community to manage the population health according to framework, but demonstrates a direction for identifying any and all potential issues affecting health (Santacroce and Kneipp, 2021). Furthermore, it provides an effective decision-making framework for establishing an iterative path from planning, implementation, and evaluation of health programs to finding and solving issues (Bartholomew et al., 2016). Hence, the IM provides specific guidelines to systematically plan and execute health promotion programs, and may also be used as a major strategy for the community health projects (Ahn, 2015).

Accordingly, in this study, by applying the Intervention Mapping, it is intended to develop a program that is applicable and feasible in the field to help improve frailty and promote the health of frail older adults of the community.

2. Methods

2.1. Design and sample

This is a methodological study that developed a preliminary program by applying the Intervention Mapping (IM) protocol (Bartholomew et al., 2016). The program was developed across six steps:

Literature Review and Needs Assessment: In Step 1, a literature review and needs assessment were conducted.

Program Goal and Performance Objectives: In Step 2, the program goal and performance objectives were described.

Program Design: In Step 3, the program was designed based on the concepts of social networks and social support as the theoretical foundation.

Pilot Test: In Step 4, a pilot test was conducted as a one-group pre-posttest to confirm the validity and feasibility of the program.

Sustainability Confirmation: In Step 5, the sustainability of the program was confirmed through interviews with community experts involved in the program.

Evaluation Plan: In Step 6, a feasible evaluation plan was specified.

Finally, the IM-HPP (Intervention Mapping Health Promotion Program) was developed for the health promotion of frail older adults. It was created as an integrated management program that included exercise, nutritional supplementation, frailty management, education, and case management (**Table 1**).

Table 1. Program development process (intervention mapping protocol).

Step 1: Logic Model of the Problem	<ul style="list-style-type: none"> Local community group composition and meetings Characteristics of subjects, verification of health problems for which intervention is possible (identify needs) (literature review and epidemiologic data) Understanding of subjects needs and local community resources that can be injected (local community group meetings) Evaluation of existing program effectiveness and goal setting for new program (literature review)
Step 2: Program Outcomes and Objectives: Logic Model of Change	<ul style="list-style-type: none"> Description of results expected regarding behavior and environment for frail elderly Materialization of fortitude Select determinants for behavior and environmental outcomes Construction of matrices of frail elderly
Step 3: Program Design	<ul style="list-style-type: none"> Generation of program themes, components, scope, and sequence Choosing of theory-based interventions (social support, social network) Selection of practical applications to deliver change methods
Step 4: Program Production	<ul style="list-style-type: none"> Program development Validity verification Pilot test (One-group pretest-posttest design) Modification of program (survey, focus group interview)
Step 5: Program Implementation Plan	<ul style="list-style-type: none"> Search of implementation plans (B local community group meetings) Verification of planners, production staff, and program users Search of sustainable method
Step 6: Evaluation Plan	<ul style="list-style-type: none"> Determination of evaluation measures Plan evaluation of effectiveness

2.2. Procedure

• Step 1: Logic Model of the Problem

A systematic review was conducted to assess the health needs of frail older adults residing in the community. A systematic review was conducted using electronic bibliographic databases Pubmed, Embase, Cochrane Library, CINAHL, and Riss to search 1793 articles from 1986 to the point of time of the study, and reviewed the

characteristics of frail older adults, possible health issues to intervene, and the effectiveness of the intervention program (Nam, 2019). The analysis of epidemiological data is essential for the clear identification of health problems. This analysis is further validated through expert group interviews, which confirm the essence of the health problems. Focus group interviews were conducted with a total of 5 community experts, including Health Center nursing visiting team managers and community visiting nurses, and verified the health needs of local residents. Furthermore, the characteristics of the region, the needs of the subjects, and the available resources were identified.

- Step 2: Program Outcomes and Objectives; Logic Model of change

The program goals and performance objectives that may be achieved after the program intervention are described. After providing the program, changeable internal determinants and external determinants were selected and linked to performance objectives. Furthermore, among the behavioral factors and environmental factors, the outcomes affected by determinants were identified, and the behavioral outcomes and environmental outcomes were derived to create a matrix.

- Step 3: Program Design

The subject, components, scope and order of the program were set. As an effective way to change behavioral or environmental determinants that interfere with health promotion, it was designed to strengthen the intervention by applying the concept of social support and social network to the program.

- Step 4: Program Production

Seven experts (community nursing professors, doctor of nutrition, PHNs, and public health center workers) validated the content validity of the derived preliminary program, and some changes were made to the curriculum and contents through expert consensus. Fifteen subjects who fit the selection criteria were recruited, an 8-week pilot test was conducted, and the program was evaluated through the focus group interviews.

The subjects were pre-frail older adults in Korea who were subject to a home visit of community public health center. They were in an intermediate frail state, without cognitive impairment and were able to communicate, and were selected as the subjects between the ages of 65 and 85. Sample size was calculated using G*Power 3.1 (Faul et al., 2009). Based on a study (Kwon and Park, 2013) of an exercise program targeting frail older adults, given a single-group *t*-test, effect size 0.8, significance level 0.05, power 0.8, they were at least 12 people, yet considering the dropout rate of 20%, 15 people were recruited. Surveys, physical measurements, and blood tests were conducted, and the collected data were analyzed using the SPSS/WIN 23.0 statistical program. The differences before and after the intervention were identified by Wilcoxon signed ranks test, and the FGI results were confirmed through the content analysis.

- Step 5: Program Implementation Plan

Interviews were conducted with 5 community health experts to search a sustainable operation plan for the modified program. Program users, program planners, and program production staff were specified to identify the predictable issues in terms of the program operation.

- Step 6: Evaluation Plan

An evaluation of the program was planned. A feasible evaluation plan was specified by selecting evaluation indicators and evaluation tools for measuring the effect.

3. Result

- Step 1: Logic Model of the Problem

As a result of literature review, frail older adults demonstrated characteristic physical changes such as the decreased muscular strength and reduced walking speed, and psychosocial changes such as depression and feelings of isolation were also observed (Cameron et al., 2013; Kim et al., 2015; Ng et al., 2015). Moreover, social support was crucial as frailty could increase in the absence of social, emotional, or environmental support, even in the absence of physical changes related to frailty (Whitson et al., 2007). However, the type, frequency, and duration of common programs whose effectiveness was proven to confirm the improvement of frailty could not be confirmed. However, most programs ran an intervention period of 12 weeks to 12 months, each intervention time of 30 to 90 min, and 1 to 3 interventions a week. As for the intervention method, an integrated program was effective (Cameron et al., 2013), yet providing the multi-domain interventions such as exercise, health supplements, nutrition through food, education, and social support was more effective, albeit limited, than the mono intervention (Chen et al., 2020). Exercise made it possible for the frail older adults to improve their physical functions, such as increased grip strength, a shortened 5m walking speed, and increased static balance (Choi and Kim, 2013). Most of the exercise programs consisted of low-intensity strength training for muscle stretching and improvement of joint range of motion, but uncertainty still exists with regard to which exercise characteristics are most effective (type, frequency, duration) (Giné-Garriga et al., 2014; Haider et al., 2019). As for the provision of supplements, commercially available products made of single preparations or complex preparations such as protein, fat, carbohydrates, zinc, iron, vitamin B, vitamin D, and minerals were provided (Racey et al., 2021), or nutritional advice interventions were provided (Yin et al., 2021). The intervention programs including nutritional supplements affected the hematological test results (Seino et al., 2017). The programs that included social support mostly promoted relationships through phone calls or face-to-face meetings (Luger et al., 2016; Tarazona-Santabalbina et al., 2016). Such programs reduced the level of depression and increased the social participation (Tarazona-Santabalbina et al., 2016), improved the quality of life of the frail older adults, and played a role in reducing the stress factors (Luger et al., 2016).

After confirming the effectiveness of the program in the systematic review, epidemiological data were analyzed. And it was confirmed that certain regions had a large number of low-income older adults living alone. However, limitations were identified in confirming the level of frailty in certain regions. Experts from specific regions where vulnerable elderly populations were identified were selected to identify specific health problems related to frailty. the focus group interviews were conducted with five local community experts to confirm the health needs of local residents. Furthermore, the characteristics of the region, the needs of the subjects, and resources that may be input were identified. The difficulty of the actual operation process was

confirmed, and based on which, major concepts were derived. The Logic Model of the Problem and a conceptual framework were created by synthesizing the results of the systematic review and interview **Figures 1 and 2**.

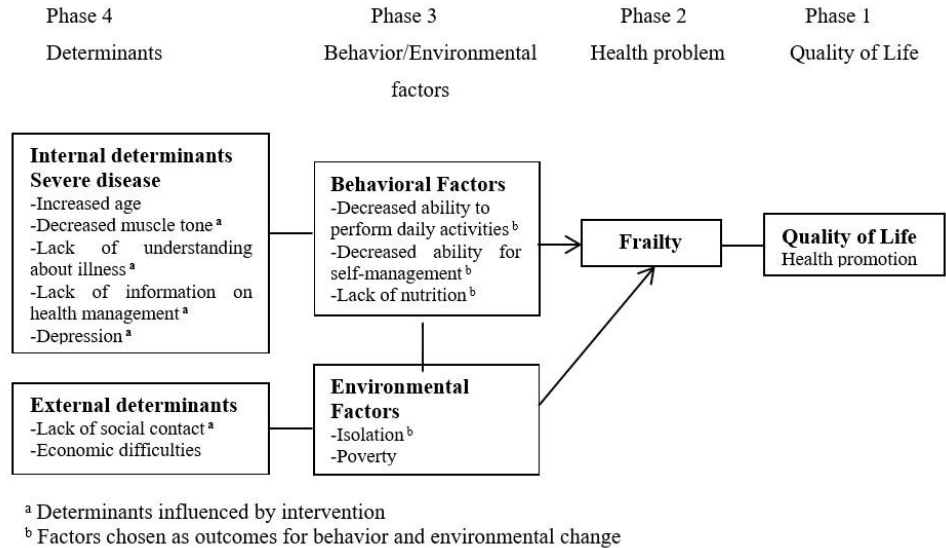


Figure 1. Logic model of the problem.

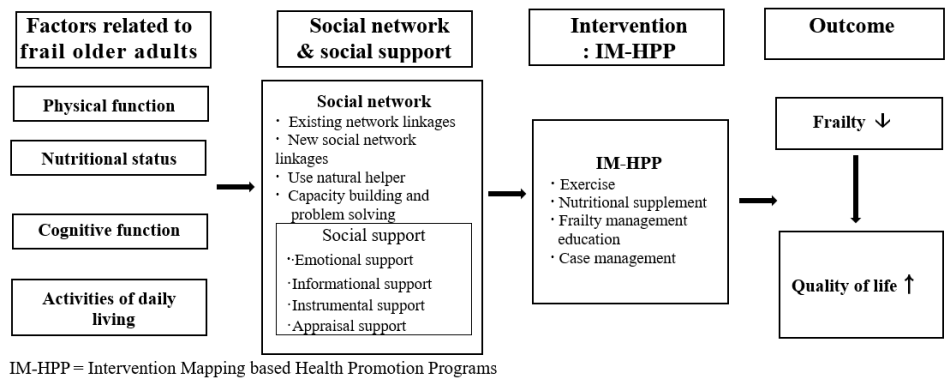


Figure 2. Conceptual framework of the research.

• **Step 2: Program Outcomes and Objectives; Logic Model of Change**

The program goal was set to ‘Improve the quality of life among frail older adults,’ and the performance objectives to achieve the program objective of ‘Health promotion for frail older adults’ were specified. Among the determinants derived in Step 1, those influenced by intervention factors were applied to create the five performance objectives, which were increase muscular strength, increase knowledge on illnesses, acquire health care information, reduce depression, and promote fellowship among local community. As for the 5 performance objectives, the four factors of behavioral factors (decreased ability to perform daily activities, decreased ability for self-management, lack of nutrition) and the environmental factors (isolation) derived as the ‘factors chosen as outcomes for behavior and environment change’ from among the behavior and environmental factors of Step 1 were each connected to complete the matrix (**Table 2**).

Table 2. Matrices for health promotion program for frail older adult.

Performance objectives	Program goal: Improving the quality of life among frail older adult			
	Program objective: Health promotion for frail older adult			
	Behavioral factors			Environmental factors
	1) Decreased ability to perform daily activities	2) Decreased ability for self-management	3) Lack of nutrition	4) Isolation
Increase muscular strength	Low-intensity exercise education Provision of exercise posters for durability	Recording daily exercise through self-checklist	Provision of supplementation	Distribution of exercise posters in senior citizen centers
Increase knowledge on illnesses	Provision of health management related education	Management of illness condition through continuous case management	Recording of daily intake through self-checklist	Selection of dong-resident centers, health centers as program site
Acquire health management information	Provision of health management related education	Education on self-management methods	Provision of education for healthy eating habits	Selection of dong-resident centers, health centers as program site
Reduce depression	Encouragement to articulate aging, illness, pain	Continuous monitoring of depression levels through case management	Home visits by nurse for nutritional intake verification	Continuous contact through phone consultations
Promote fellowship among local community	Program guidance in close community center, senior citizens center	Encouragement for continuous program participation	Request for continuous supply of nutritious food through local community center	Provision of social support to subjects through phone consultations

- Step 3: Program Design

Themes, components, scope and sequence for health promotion program were set based on the detailed intervention contents presented in Step 2. With ‘frailty’, an issue derived from the Logic Model, as the concept of focus, ‘health promotion for frail older adults’ was set as the theme of the program. The components were set to education (nutrition, disease management), exercise, case management, provision of nutrition supplementation, etc., which were derived as the detailed intervention methods in the frail older adults matrix. The scope was set to improve health awareness among the frail older adults and teach them self-management methods. Sequence was structured to increase social contact and acquire skills and management skills that can solve the issue of frailty on their own. Ultimately, the purpose was to cultivate the self-management skills related to frailty within social relationships. Thereafter, the Logic Model of the Problem was materialized by specifying methods and practical applications to achieve four ‘factors chosen as outcomes for behavior and environment change’ and set performance objectives **Figure 1**. To maximize the effect of the program to improve the health of community residents, the concepts of social support and social network were used as the methods of reinforcement.

Support methods such as emotional support, informational support, instrumental support, and appraisal support were connected to the factors, and a social network was applied as the practical applications. As for the social network formation, specific methods were described by applying the existing linkages promotion, new linkages development, internal helper capacity building, promotion competence, and the relationship network promotion through problem solving (Glanz et al., 2008).

- Step 4: Program Production

The 8-week preparatory program consisted of on-site intervention for 60 min once a week, 30 min of education (nutrition, disease management) by PHNs, 30 min of exercise, and case management through the phone calls once a week. The disease education of the 8-week on-site intervention consisted of content for frail older adults' understanding of diseases, including chronic diseases, and health care, and nutrition education consisted of content on the appropriate amount of necessary nutrients and intake methods. As for the exercise, there was no consistent standard for the structure and method of literature review results, and hence, based on the results of a preceding study (Kwon and Park, 2013) targeting frail older adults of community and the results of interviews with community group representatives, it was consisted of 30 min at a time, once a week for 8 weeks. Low-intensity strength exercise for frail older adults

Table 3. Comparison of dependent variables after program ($N = 11$).

Variables	Pretest	Posttest	Z	p
	M ± SD	M ± SD		
Frailty level	11.91 ± 1.30	10.00 ± 2.72	-2.02	0.043
Physical function				
Systolic blood pressure (mmHg)	137.82 ± 21.42	133.73 ± 11.82	-0.26	0.799
Diastolic blood pressure (mmHg)	81.09 ± 12.30	77.91 ± 8.35	-1.12	0.261
Weight (kg)	59.33 ± 6.60	59.19 ± 6.40	-1.36	0.174
Body mass index (kg/m ²)	25.31 ± 4.32	25.27 ± 4.21	-1.02	0.306
Hand grip strength (kg)	20.00 ± 4.54	18.02 ± 4.34	1.99	0.074
5 m gait-regular (sec)	5.90 ± 1.03	6.39 ± 1.09	-3.29	0.008
5 m gait-fast (sec)	5.14 ± 1.15	5.08 ± 1.11	0.48	0.642
Depression	8.27 ± 3.55	6.90 ± 3.21	-1.28	0.201
Quality of life	0.69 ± 0.18	0.77 ± 0.18	-1.36	0.173
Nutritional status				
Appetite	12.91 ± 2.51	12.73 ± 2.45	-0.63	0.527
Nutrition	23.55 ± 2.41	25.23 ± 2.97	-2.28	0.023
Carbohydrate				
Fasting blood sugar (mg/dl)	91.00 ± 14.58	93.55 ± 16.54	-0.26	0.799
Lipid				
Total cholesterol (mg/dl)	175.82 ± 37.23	169.27 ± 30.94	-0.97	0.333
High density lipoprotein (mg/dl)	45.09 ± 8.96	45.64 ± 7.81	-0.40	0.687
Triglycerides (mg/dl)	147.00 ± 62.97	144.82 ± 58.33	-0.18	0.859
Protein				
Albumin (g/dl)	4.15 ± 0.26	4.10 ± 0.17	-0.78	0.438
Social support	53.27 ± 12.40	59.82 ± 13.20	-2.81	0.005

Frailty level (Korean Frailty Scale; Community integrated health promotion program guide 0–3 (healthy), 4–12 (pre-frailty, intermediate frail state, high-risk frailty group), 13 or more (frailty), depression (Geriatric Depression Scale Short Form Korea Version), quality of life (EuroQol Group), appetite (Short Nutritional Assessment Questionnaire). Nutrition (Mini Nutritional Assessment), social support (Multidimensional Scale of Perceived Social Support). Z = Wilcoxon signed ranked test.

consisted of 5 min of preparatory gymnastics, 20 min of strength exercise, and 5 minutes of well-organized gymnastics for a total of 30 min. Case management was

carried out for 20 min at a time by comprehensively evaluating the subject's general characteristics, frailty related characteristics, physical function, nutritional status, mental function, and social interaction before intervention, checking the health level, and individually supporting them. Furthermore, the commercially available vitamin supplement products that can help frail older adults manage their health were provided throughout the program. The final 11 of the pilot test subjects completed the program, and then the satisfaction level was evaluated through a focus group interview. As a result of the program, the significant and positive effects were derived at the frailty level, 5 m gait (regular), nutrition score, and social support (**Table 3**).

The final program was completed by modifying the program contents based on the results of the program and the thematic collection results derived based on the interviews.

- **Step 5: Program Implementation Plan**

Based on the results of the pilot study, interviews were conducted with local health experts to check the continuity of this program. As for the final program, the location of the on-site program was changed from the local public health center to the community center with high accessibility to reduce the dropout rate of the subjects. After confirming that exercise after the end of the program lacked the effect of improving the physical function of frail older adults, the program was modified to provide an additional exercise schedule and create a self-checklist to increase the number of exercises. Vitamin supplements did not actually help the nutritional status of the subjects. Hence, a previous study (Cherniack et al., 2007) suggested that frail older adults had a positive effect on muscle mass increase, and replaced it with a nutritional supplement containing vitamin D, calcium supplements, and amino acid supplements. Furthermore, it was confirmed that in many cases they could not eat 3 meals a day due to decreased ability to perform daily activities, and senior nutrition porridge (40 g, 165 kcal) in the form of high protein liquid food was provided twice a day. Furthermore, reinforcement was planned by providing a picture leaflet of 'Healthy Diet' in the form of sticking on the refrigerator. Since the level of depression did not improve, the final program modified to conduct additional case management by pre-selecting subjects with a high level of depression in the preliminary survey results. To promote social interaction, starting from the 5th week of the program, it was modified to provide additional small group meeting time to share the opinions on the individual health care methods.

- **Step 6: Evaluation Plan**

As a result of the pilot study, test items that were ineffective in hematological tests were excluded from the final evaluation plan. To simplify the blood sampling procedure, which patients complained of discomfort, it was changed to only measure blood sugar and cholesterol using a simple measuring device. Furthermore, since it was not enough to measure social support with a single tool, it was modified to add the Lubben social network scale. For the final effect evaluation of the developed program, a region identical to the pilot test was selected and operated with a nonequivalent control-group pretest-posttest design. The final effectiveness evaluation and qualitative evaluation will be presented in separate articles.

4. Discussion

This study used a theory-based protocol to clearly distinguish determinants leading to frailty, behavioral and environmental factors, and derived changeable outcome indicators. This implementation of feasible intervention methods that reflect the needs of the target audience and community, resulting in an effective program.

The systematic review and demand survey of Step 1 were the important Steps to accurately identify the cause of frailty. Based on the analytical results, a logic model was completed, which made it possible to check the process to reach the final outcome variable, quality of life, at a glance. This led to systematic notions of cause and effect and gave new perspectives on what appropriate interventions might be (Jiménez-Aguilar et al., 2019; Nielsen et al., 2018; Taylor et al., 2013). In a gender-relevant tobacco cessation intervention study targeting women in Brazil (Kienen et al., 2019), the establishment of a network of representatives from different segments of society followed by comprehensive needs assessments. It is similar to this study in that the various related expert groups identified the final outcome variables and established a logical framework based on them. Steps 2 and 3 specified the contents of the program to induce positive health changes that are expected to change through intervention. As a result, it was confirmed that the results of Step 3 correspond to some extent with the effective program method recognized in the systematic review of Step 1. Furthermore, the most appropriate theory was selected to improve the determinants, behavior, and environmental factors derived from the logic model. The results of studies (Ahn, 2015; Kienen et al., 2019) that applied theories such as self-determination theory, social cognitive theory, and social support were similar to those of the present study. The application of the concept of social support enabled the identification of crucial intervention strategies that can facilitate individual and interpersonal health promotion.

Such theory-based program set the exact direction of the program and suggested a specific role to promote behavioral change of the subject. In this regard, the final program modified and supplemented by applying the theory may be said to be highly useful. In Step 4, a pilot test was conducted and a focus group interview was conducted to increase the effectiveness of the program, which was an opportunity to identify and prepare for issues in advance during the final program process. Following the completion of the pilot test, the location of the intervention was modified in order to enhance accessibility for the subjects. An additional exercise schedule was introduced with the objective of improving physical activity, while complex supplements and high-protein liquid food were provided with the intention of enhancing nutritional status. Furthermore, the final program was adapted to incorporate additional case management and small-group meeting time, with the aim of improving depression. The final revisions were incorporated into steps 5 and 6, and a specific and actionable evaluation plan was established with the objective of ensuring stable operation. This process increases the feasibility of the final program and enables the successful achievement of the goal. In an intervention developed according to an intervention mapping protocol to improve the drug compliance for non-adherent patients with rheumatoid arthritis (Zwicker et al., 2012), the expert panel and patient panel in the pilot study step. It was also confirmed that a detailed report on the instrument was made, and based on which, the perfection of the intervention was improved.

Furthermore, this study designed a program using community public health center workers and PHNs among the human resources to increase the effectiveness and feasibility of the program. This is similar to a study (Ahn, 2015) where the self-management support program was executed in conjunction with a new program by applying the intervention mapping.

Furthermore, the Intervention Mapping made it possible to confirm the establishment of a community cooperation system from an ecological point of view. In the entire process from Step 1 to Step 6, the issues were identified and demands were derived by continuously connecting with community resources such as community public health centers, community centers, PHNs, and local residents. The establishment of a program support system through involvement of all stakeholders in the entire program process means that it builds trust and promotes ownership which can assure sustainability (Kienen et al., 2019). In this study, the most important continuity and stability for community health care were secured based on the activities carried out such as by establishing a health care system that can be operated in a connected manner by utilizing community resources to maintain the program after development through IM, and establishing support relationships within the community. The frail older adults program applying the Intervention Mapping was an effective method for nurses and stakeholders to plan, implement, and evaluate systematic interventions based on scientific grounds, and had sufficient advantages for planning complex multilevel interventions or multiple compatible interventions (Santacroe and Kneipp, 2021).

4.1. Strengths and limitations

A limitation of this study is the fact that a program model from an ecological perspective, which is considered important in community intervention, for the complete application of intervention mapping could not be developed. While the ecological interventions were identified and included for the intervention factors according to the Intervention Mapping protocol, specific intervention strategies at the individual, interpersonal, community, and policy levels were not established from a holistic perspective. Furthermore, a limitation of the pilot test is that the effect of the preparatory program was evaluated through a small size non-control group study, and the final program was confirmed based on such. Additionally, The IM-HPP is an integrated management program for the frail elderly, and the results cannot be specified for each variable. The strength is the fact that it completed the frail older adults intervention program protocol that can develop the community's capacity by developing a program that faithfully reflects the six steps from the needs survey to the evaluation step. Furthermore, by systematically applying the pilot study process, feasibility for the target group was confirmed, albeit limited. The strength of this study is such that the real-life setting program was made possible by the participation of the program operator, subjects, and community stakeholders from the planning step of the program. The development of this program was developed, modified, and verified according to a clear protocol, and it will be a specific and systematic guideline when community health personnel develop new health promotion programs for community subjects moving forward.

4.2. Conclusion and practical implications

The program development applying the Intervention Mapping protocol developed a support system that included all stakeholders of the community and a cooperative system. Based on which, all stakeholders engage in a participatory decision-making process. Furthermore, it provided a framework of a logical model useful for surveying the needs of subjects, planning programs, implementation, and evaluation. In particular, the pilot test included in Step 4 enabled the confirmation of the feasibility of the target group and can provide a clear process for the spread and application of the program. It may also be used as a scientific program development guideline for the community nurses who operate the health promotion programs in the community, such as the PHNs and school nurses. It may be sufficiently modified and used for the development of other health promotion programs, and it will be a useful data for the health promotion of subjects of the community.

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Ethical approval: This study was approved by the Institutional Review Board of the Catholic University of Korea (MC17FESI0099, 12 December 2017). Informed consent was obtained from all participants.

Conflict of interest: The authors declare no conflict of interest.

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