



Research Article

Development and Validation of an Interprofessional Collaboration Scale for Home Health Care for the Frail Elderly

Keiko Tsukasaki,^{*} Kaoru Kyota, Tomoya Itatani

Faculty of Health Sciences, Kanazawa University, Japan

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SUMMARY

Purpose: The purpose of this study was to develop an interprofessional collaboration (IPC) scale for home health care for frail elderly.

Methods: The first items of the IPC scale included collaboration members' attitudes, awareness, motivation, team strength, communication, relationships, information, care recipients' interests, effects, development, utilization of social resources, contributions to the community, and crisis management. The subjects were 512 care managers who work in home care support offices across Japan. They manage interprofessional collaboration in home health care for frail elderly who need care at 65 years old and above. The scale's construct validity, internal consistency, the validity of known groups, concurrent validity, and test-retest reliability (193 subjects) were examined.

Results: The final IPC scale's items consisted of four factors (37 items): the strength of interprofessional teams (16), the management of collaborative systems (7), effects of collaboration (8), and communication (6). Four factors explained 58.6% of the total explained variance. The modified model fit of the scale achieved acceptable levels. The Cronbach's α coefficient for all items was .97. The sum of communication factor in the cities/wards group was lower than those in the towns/villages group. There were differences between the sum and each factor with different levels of ease to collaborate. The intraclass correlation coefficient for all items in the first and second assessments was .875.

Conclusions: The validity and reliability of the IPC scale have been verified. This scale can be used to assess the IPC for home health care for frail elderly.

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Introduction

Many developed countries are presently facing the challenges of an aging population, leading to an increase in the number of elderly people who require support and nursing care for health management every day. Japan has become a super-aging society in which the elderly account for more than 21.0% of the population, and the number of frail elderly people with impaired mental, physical, and cognitive functions has been rising [1]. Therefore, Japan has the urgent task of recruiting a variety of health professionals from medical, nursing, and welfare fields, among others, to develop efficient collaborative systems across the nation that can provide the elderly with high-quality support.

The World Health Organization declared 'action on interprofessional education and collaborative practice' to be an important

strategy that is required to address the issue of the serious shortage of health professionals around the world [2]. Many countries have emphasized the importance of interprofessional collaboration and its promotion, as well as the implementation of education to help health professionals improve their collaboration skills [3,4].

In Japan, care managers are in charge of coordinating interprofessional collaboration for frail elderly people in the community who require health care. Care managers coordinate interprofessional collaboration among health professionals working in medical, nursing, and welfare facilities according to the healthcare insurance system and develop home care plans for each recipient to provide frail elderly the required home and nursing care services.

Community-based integrated care systems for the elderly that provide health/nursing care and daily support are being developed in many areas across Japan to create a society in which the elderly hoping to continue their community lives will be able to do so. Care managers are expected to serve as coordinators who facilitate collaboration among a variety of health professionals in such care systems. Therefore, they are aware of the obstacles of relationships with physicians, professional competency, relationships among

Keiko Tsukasaki: <https://orcid.org/0000-0001-5429-4399>

^{*} Correspondence to: Faculty of Health Sciences, Kanazawa University, Japan. Fax: +81 76-234-4363.

E-mail address: tsukasak@staff.kanazawa-u.ac.jp

other professionals, environmental constraints, and relationships with non-professionals [5]. These obstacles must overcome to strengthen interprofessional collaboration in their community.

Although previous studies conducted in many different countries have indicated the need for interprofessional collaboration to support the elderly living in the community, research that examines the effects of the collaborative activities has focused on limited areas [6]. In addition, no previous studies have presented sufficient evidence of the cost-effectiveness of collaborative activities [7].

Although it is necessary to conduct longitudinal assessments to examine the effects of collaborative activities [8], comparing collaborative effects is difficult. Because the elderly increasingly requires greater support as they become older, and systems and environments required to promote collaboration vary depending on the country, area, and era. However, if there is assessment scale of the functions of interprofessional teams, the functions of interprofessional teams in different systems, supportive environments, countries, and areas can be assessed and/or compared longitudinally and continuously.

Several scales have been developed to assess the functions of interprofessional teams that provide health care at different health levels in general hospitals, communities, and other such places. These scales include the assessment of inter-professional team collaboration scale (AITCS) [9], collaborative practice assessment tool (CPAT) [10], partnership self-assessment tool [11], and other scales with an emphasis on 'team climate' [12], 'the quality of team meetings' [13], and the sharing of decision making [14].

The concept of interprofessional collaboration to support the elderly with chronic diseases living in the community is evolving antecedent, attribute, and consequence but does not get consensus [15]. The functions of interprofessional collaboration required to provide home care for the elderly living in the community must be discussed in order to develop the criteria for their assessment.

This study aimed to define the concept and examine the functions of interprofessional collaboration required to support the health and lives of frail elderly people living in the community, in order to develop an interprofessional collaboration (IPC) scale for home health care for frail elderly. The IPC scale, developed in Japan, a super-aging society, will also be useful in many other countries that are facing the consequences of an aging population.

'Frail elderly' in this study refers to people aged 65 years and above who have been certified as requiring long-term care (people who need others to care for them) because of physical or mental problems or because aging interferes with their daily activities. In Japan, a long-term care insurance system allows those certified as needing long-term care, regardless of whether they live with their family, to receive public services. These include nursing care or home-visit nursing care from various organizations while living in their own home.

People who use such services need a home healthcare plan. Nevertheless, home care support offices are private organizations. These offices have staff members certified as care managers. They plan home health care regarding the necessary services for the frail elderly living at home. They also manage home health care so that various professionals from several organizations can collaborate to provide support.

Methods

Scale development

Conceptual framework

The definition of the concept of interprofessional collaboration required to provide home care for the frail elderly living in the

community, and the development of the plans for the assessment index are described below.

To define this concept, reports pertaining to interprofessional collaboration were examined [3,4], and the differences between collaboration and similar concepts, including cooperation and liaisons, were analyzed. Interprofessional collaboration for providing home care is thus defined as 'collaboration among multiple professionals from different organizations who have expertise in each field, including mutual communication, the development of trusting relationships, and setting common goals to help the elderly users of home care services and their families live a high-quality life or fulfil their hopes.'

Preliminary items

Based on the definition above, personal and group interviews with nine health, medical, and welfare professionals were conducted. These professionals included care managers, home-visit nurses, nursing care workers, pharmacists, and physicians involved in activities that support the elderly in the community. They were asked about their experience regarding interprofessional collaboration as defined by the authors, including what they thought were important in promoting interprofessional collaboration. Based on their response, 58 items were identified as important elements for promoting interprofessional collaboration. These were divided into 10 areas, such as members' attitude, strength of teams, and communication.

Subsequently, a pilot survey with 24 care managers was conducted to examine the validity of the prototype, including its face validity, and a draft assessment index consisting of eight fields and 55 items was created.

Evaluation of the IPC scale

Setting and samples

The subjects were care managers working in home care support offices located in Japan's 47 prefectures. Of the 39,124 centers in the 47 prefectures (as of June 2016) [16], 1,962 centers were selected. A representative from each center was asked to participate in the study; the care manager from each center who most frequently collaborated with other health professionals responded to the originally developed questionnaire. The 1,962 centers were selected based on a stratified random sampling method, taking into consideration the ratio of the number of special administrative regions, ordinance-designated cities, core cities, and municipalities (1,761 as of October 2016). All 47 prefectures had at least one of these 1,962 centers.

Survey methods

Anonymous, self-completion questionnaire forms were sent to the subjects by mail, and they returned the completed forms to the researcher.

Survey period

The survey period was between July and August 2017.

Survey items

- (1) Characteristics and ease of collaboration of subjects

The survey items included the names of the prefectures in which the healthcare institutions were located, administrative classification, sex, age, certificates other than care manager, period of

working as a care manager, the number of care recipients for whom they are responsible, frequency of meeting professionals from other healthcare institutions per month, frequency of participating in workshops on interprofessional collaboration per year, and ease of collaboration with other healthcare institutions and professionals (using a three-point scale).

(2) Items for the assessment of the functions of interprofessional collaboration

The following eight fields and 55 items of the draft were adopted: Field I: six items (Questions 1 to 6) related to attitudes toward and awareness of collaboration (understanding of/respect for the specialties of others and the recognition of the need for interprofessional collaboration); Field II: 11 items (Questions 7 to 17) related to the strength of teams (same goals for the activities of teams and roles within teams); Field III: nine items (Questions 18 to 26) related to communication and relationships (exchange of opinions and interaction with respect for other people's positions); Field IV: nine items (Questions 27 to 35) related to information (sharing/management of information and responsibility); Field V: six items (Questions 36 to 41) related to care recipients' interests (support centered on care recipients, satisfaction of care recipients and their families, and the status of their participation); Field VI: 10 items (Questions 42 to 51) related to the effects of collaboration (identification of problems to address and improve them through collaboration); Field VII: two items (Questions 52 and 53) related to the utilization of social resources and contributions to the community (status of the effective utilization of social resources and the level of contribution to the community through collaboration); and Field VIII: two crisis management-related items (Questions 54 and 55) pertaining to early identification of problems and responses in emergency situations.

Responses to each question were based on a seven-point Likert scale: 'Definitely yes' (7 points) to 'Definitely no' (1 point); the higher the collaborative function, the higher was the score.

Data analysis

Correlations between the scores for each question item to assess collaboration and the sum of these scores were analyzed and inter-item analyses were conducted. Question items were then selected based on the analysis results. Exploratory factor analyses using the maximum-likelihood method and promax rotation were performed, and the obtained factor structure was matched to the eight fields of the assessment index draft to examine the validity of the construct. Subsequently, Cronbach's α for each factor related to interprofessional collaboration and the question items was calculated to examine internal consistency.

Since there are differences in the social structures and resources of cities/wards and towns/villages because of their varying population sizes, the functions of collaboration in cities and wards may differ from those in smaller municipalities. The factors related to collaboration and the sum of the assessment scores for 'cities/wards' and 'towns/villages' groups were compared using χ^2 and *t*-tests.

High-level collaborative functions are considered to be associated with the ease of collaboration with other healthcare institutions and professionals. Therefore, the factors related to collaboration and the sum of the assessment scores were compared with different levels of ease using one-way analysis of variance and multiple comparison to examine the concurrent validity.

The second survey was conducted approximately 10 days after the first to calculate the intraclass correlation coefficient (ICC) for the first and second assessments.

SPSS Statistics Ver.22 and AMOS Ver.22 (IBM Corp., Armonk, NY, USA) and G*Power 3.1.9.1 (The G*Power Team, Heinrich-Heine-Universität, Düsseldorf, Germany) were used for the analyses. The significance level was 5.0%.

Ethical considerations

This study was approved by an Institutional Review Board of the institution to which the researchers belong. The participation of subjects was voluntary, and their submission of a completed questionnaire form was regarded as their consent to participate in the study. The subjects provided written consent to participate in the interviews and pilot surveys.

Results

A total of 564 care managers responded (response rate: 28.7%), and the 512 respondents who answered all of the questions contained in the assessment index draft were selected as the subjects for analysis (valid response rate: 90.8%). Of the 512 subjects, 194 responded to the re-test (response rate: 37.9%), and 193 valid responses were collected (valid response rate: 99.5%).

Subjects' characteristics

Of the 512 subjects, 43.8% and 56.3% worked in centers located in cities/wards and towns/villages, respectively. The majority of the participants were female (76.6%) and were in their 50s (39.1%). Furthermore, most were former qualified healthcare workers (56.8%). The mean period of working as a care manager was 9.4 years. The mean care ratio was one care manager to 30.9 elderly people. The care managers met health professionals from other institutions 4.4 times a month (mean) and participated in workshops on interprofessional collaboration 4.6 times a year (mean) (Table 1).

Construct validity

Correlation coefficients between each assessment score and the sum were 0.4 or higher. The correlation coefficient between one assessment score and the sum was 0.81 as a result of the inter-item correlation analysis and that question item was excluded to simplify the index.

Exploratory factor analysis was conducted based on the maximum-likelihood method and promax rotation; the number of factors was five, decided by using a scree plot. Factor analyses were conducted seven times until assessment items with a factor loading of 0.4 or lower (a total of 15 items) were excluded. As the eigenvalue of the fifth factor was lower than 1, an analysis involving four factors was conducted excluding two items (Field VIII) included in the fifth factor. There were no items with a factor loading of 0.4 or lower as a result of the analysis, and the four factors (37 items) were adopted. The contribution rates of the four factors were between 3.7% and 46.5%, and the cumulative contribution rate was 58.6%. Correlation coefficients among the factors were between 0.59 and 0.73, which suggest significant correlations (Table 2).

The first factor consisting of Fields I and II (16 items) included in the assessment index draft was titled 'Team strength.' The second factor consisting of Fields IV, VI, and VII (seven items) was titled 'Management of collaborative systems.' The third factor consisting of Fields V and VI (eight items) was titled 'Effects of collaboration.' The fourth factor consisting of Fields III and IV (six items) was titled 'Communication.'

Table 1 Subjects' Characteristics.

Items	Categories	Number (%) / M ± SD
Administrative classification of areas in which the institutions were located N = 512	Cities/wards	224 (43.8)
	Towns/villages	288 (56.3)
Gender N = 508 ^a	Men	119 (23.4)
	Women	389 (76.6)
Age N = 506 ^a	In their 30s	53 (10.5)
	In their 40s	182 (36.0)
	In their 50s	198 (39.1)
	In their 60s	73 (14.4)
Certificates (multiple answers allowed) N = 512	Health care workers	291 (56.8)
	Participants who had completed training for new health care providers	114 (22.3)
	Nurses	89 (17.4)
	Social workers	76 (14.8)
	Other professionals (pharmacists, dietitians, etc.)	75 (14.7)
Time working as a care manager (years) N = 510 ^a		9.41 ± 4.76
Number of care recipients under the care of the care managers (Number of recipients per care manager) N = 502 ^a		30.86 ± 9.16
Frequency of meeting professionals from other institutions (per month) N = 509 ^a		4.36 ± 3.34
Frequency of participating in workshops related to collaboration (per year) N = 492 ^a		4.62 ± 6.38

Note. M = mean, SD = standard deviation.

^a The number excludes subjects that did not answer this question.

Internal consistency

The Cronbach's α coefficient for all 37 items was 0.97, and those for each factor were between 0.88 and 0.95 (Table 2).

Validity of known groups

The mean of the sum of assessment scores for the six 'communication'-related items in the cities/wards group ($n = 224$) was 31.5 ± 5.7 , which was lower than the mean of the sum in the towns/villages group ($n = 288$, 32.6 ± 5.0) ($t = -2.33$, $p = .02$, $ES = 0.205$, $1-\beta = 0.633$). There were no significant differences between the other three factors and the sum of all items.

Concurrent validity

We used levels of ease in collaboration with other healthcare institutions and professionals to examine concurrent validity.

There were significant differences between the score for each factor and the sum of the three groups with different levels of ease to collaborate with other healthcare institutions. The results of the multiple comparisons indicated that scores for 'Definitely yes' were significantly higher than those for 'Yes' and 'No' (Table 3).

There were also significant differences between the score for each factor and the sum of the three groups with different levels of ease to collaborate with other healthcare professionals. Multiple comparisons of scores for each factor and the sum of scores for all items indicated that scores for 'Definitely yes' were the highest, followed by those for 'Yes' and 'No' (Table 4).

Test-retest reliability

The retest target was the 512 people who participated in the initial survey. It was conducted approximately 10 days after the initial survey. It was thought that the health conditions of the frail elderly or the content of interprofessional collaboration would not change significantly within 10 days. Further, participants needed to be given at least 10 days following the initial survey so that they would not feel overburdened. A total of 193 people responded to the retest and became the subject of analysis.

A re-test involving 193 subjects was conducted, and the ICC for all items in the first and second assessments was .875 [95.0% CI: .835–.906] ($p < .000$); the ICCs for the first, second, third, and fourth factors were .839 [95.0% CI: .786–.878] ($p < .000$), .824 [95.0% CI: .767–.868] ($p < .000$), .816 [95.0% CI: .756–.861] ($p < .000$), and .769 [95.0% CI: .693–.826] ($p < .000$), respectively.

Discussion

This study aimed to develop the IPC scale consisting of four factors: "strength of teams," "management of collaborative systems," "effects of collaboration," and "communication." The study included care managers who coordinate interprofessional collaboration for the frail elderly living in the community and in need of health care from each prefecture in Japan. The construct validity, internal consistency, validity of known groups, concurrent validity, and test-retest reliability of the IPC scale were examined.

The contribution rate of the first factor (strength of teams) of the IPC scale was the highest (46.5%), which suggests that this factor is important in assessing the functions of collaboration. The first factor consisted of fields related to attitudes toward/awareness of interprofessional collaboration (having an understanding of/respect for the specialties of others and the recognition of the need for interprofessional collaboration) and the strength of teams (same goals for the activities of teams and roles within teams). As examples of previously developed indices to assess the functions of interprofessional collaboration, the AITCS, developed by Orchard et al. [9], consists of "cooperation" and "coordination," and the CPAT, developed by Schroder et al. [10], consists of "mission," "meaningful purpose," "goals," "general relationship," "team leadership," "general role responsibilities," and "autonomy." These items are similar to those that fall under the "strength of teams" factor in the present study. Even though the CPAT [10] consists of 56 items, the IPC scale developed in this study can intensively and simply assess the functions of interprofessional collaboration, including the "strength of teams" in home health care for the frail elderly in the community.

It has been pointed out that common interests among members of interprofessional teams promote collaboration [17] and that both "role clarification" and "collaborative leadership" are "competencies" required for collaboration [3]. Therefore, "common

Table 2 Exploratory Factor Analysis to Develop an Index for the Assessment of the Functions of Interprofessional Collaboration to Provide Home Health Care (the maximum-likelihood method and promax rotation) (N = 512).

Question items		Factor loading				Cronbach α coefficients	
		Factor 1	Factor 2	Factor 3	Factor 4	Each factor	All items
Q12	All members understand the effects of interprofessional collaboration and problems.	.922	.109	-.015	-.167	.954	.967
Q10	All members discuss how to set common goals, and cooperate with each other to fulfill them.	.889	.058	-.098	-.039		
Q9	All members discuss problems that have been identified in relation to the daily lives of care recipients.	.852	-.068	.002	-.008		
Q6	All members understand that interprofessional collaboration aims to improve the quality of support provided to care recipients.	.808	-.100	-.023	.020		
Q7	All members hope to support the lives of care recipients in collaboration with each other.	.776	-.127	.055	.034		
Q11	Roles for each member of the team have been clearly defined.	.765	-.106	.128	.020		
Q8	All members share a common understanding of the problems related to the daily lives of care recipients.	.746	-.126	.071	.091		
Q14	Members of the team, led by the leader, fulfill their roles.	.738	.101	.082	-.047		
Q5	All members recognize that it is necessary to collaborate with other professionals to solve problems.	.734	-.162	-.035	.101		
Q15	Members of the team support the leader.	.662	.214	-.036	-.037		
Q17	All members are learning about how to support provided for care recipients.	.640	.306	-.108	-.050		
Q16	All professionals in the team are allowed to dedicate themselves to provide support using their expertise and specialized skills.	.631	.051	.167	-.052		
Q2	All professionals in the team respect and trust the specialties of others.	.580	.075	-.116	.106		
Q13	The roles of the leader (coordinator) have been clearly defined.	.551	-.002	.158	.088		
Q4	All professionals in the team understand the types of support provided by others in the team and their effects.	.517	.111	-.048	.214		
Q1	All professionals in the team understand each others' expertise and specialized skills, and their functions are independent of each other.	.464	.097	-.093	.232		
Q49	The process for collaboration and methods for the assessment of results have been clearly defined.	.062	.806	-.035	-.010	.880	
Q53	Interprofessional collaboration is a community resource.	-.078	.777	-.009	-.020		
Q51	Members of the team exchange information, including what has been learned from interprofessional collaboration.	-.030	.747	.06	.000		
Q52	All professionals in the team effectively utilize social resources in the community.	-.083	.727	.095	-.011		
Q48	Procedures for collaboration are neither difficult nor a burden to perform.	.000	.681	-.037	.063		
Q50	Interprofessional teams can be organized by the professionals required to provide care for recipients on an as-required basis.	-.092	.669	.119	.123		
Q34	Members of the team discuss the measures required to address information leakage.	.088	.619	-.101	-.025		
Q37	Members of the team provide care recipients with the most appropriate care within a limited period of time.	-.105	.023	.871	-.035	.904	
Q36	Support to the life that the care recipients expect is provided.	-.052	-.063	.821	-.073		
Q42	Appropriate support is provided to respond to a variety of needs of the care recipients.	.016	.090	.769	-.014		
Q38	Explanations of the support provided to care recipients and their families are consistent.	.048	-.132	.715	.092		
Q39	Most care recipients and their families are satisfied with the support.	.018	.086	.709	-.088		
Q47	Interprofessional collaboration has the advantage of helping members of the team improve their knowledge and support skills.	.156	.122	.440	.084		
Q46	Collaboration helps members of the team reflect on their support activities and improve them.	.212	.075	.437	.113		
Q44	Collaboration helps professionals in the team address problems that need to be solved.	.192	.226	.413	.048		
Q22	Information about support can be shared even when conferences are not held by healthcare professionals.	-.017	-.006	-.048	.921	.921	
Q23	Members of the team keep in touch with each other.	.072	-.033	-.021	.876		
Q24	Members of the team can talk with each other to respond to changes in situations.	.012	-.001	.028	.825		
Q21	Members of the team exchange opinions on the types of support required by the care recipients.	.065	.130	-.016	.687		
Q20	Members of the team are acquainted with each other and understand the differences in their views.	.179	.096	-.102	.587		
Q27	Members of the team share necessary information regarding the daily lives of the care recipients.	.178	-.105	.268	.491		
Contribution rate of factors (%)		46.5	4.8	3.7	3.7		
Cumulative contribution rate of factors (%)			58.6				
Factor correlation matrix 1		—	.664	.682	.731		
2			—	.638	.586		
3				—	.618		
4					—		

Table 3 Differences in the Scores of the Index for the Assessment of the Functions of Interprofessional Collaboration to Provide Home Health Care, Focusing on Different Levels of Ease to Collaborate with Other Institutions.

	Is it easy to collaborate with other institutions?			One-way analysis of variance F value	Multiple comparison
	1 Definitely yes (n = 362) M±SD	2 Yes (n = 128) M±SD	3 No (n = 20) M±SD		
First factor: strength of teams (16 items; 112 points)	84.53 ± 12.74	74.55 ± 12.77	66.95 ± 11.98	42.47***	1 > 2,3
Second factor: management of collaborative systems (7 items; 49 points)	30.60 ± 7.21	26.54 ± 5.60	23.95 ± 5.44	23.48***	1 > 2,3
Third factor: effects of collaboration (8 items; 56 points)	42.00 ± 5.95	38.73 ± 6.16	34.85 ± 6.34	24.42***	1 > 2,3
Fourth factor: communication (6 items; 42 points)	33.28 ± 4.85	29.77 ± 5.20	26.45 ± 5.52	37.3***	1 > 2,3
All items (37 items; 259 points)	190.41 ± 26.69	169.59 ± 24.42	152.20 ± 25.73	45.2***	1 > 2,3

***p < .001.

Two subjects did not answer this question.

Note. M = mean, SD = standard deviation.

Table 4 Differences in the Scores of the Index for the Assessment of the Functions of Interprofessional Collaboration to Provide Home Health Care, Focusing on Different Levels of Ease to Collaborate with Other Health Professionals.

	Is it easy to collaborate with other health professionals?			One-way analysis of variance F value	Multiple comparison
	1 Definitely yes (n = 328) M±SD	2 Yes (n = 156) M±SD	3 No (n = 26) M±SD		
First factor: strength of teams (16 items; 112 points)	84.71 ± 12.79	76.74 ± 12.68	65.19 ± 12.07	42.63***	1 > 2,3 2 > 3
Second factor: management of collaborative systems (7 items; 49 points)	30.68 ± 7.24	27.31 ± 5.96	23.38 ± 5.15	23.39***	1 > 2,3 2 > 3
Third factor: effects of collaboration (8 items; 56 points)	42.05 ± 5.89	39.38 ± 6.17	35.04 ± 7.05	23.09***	1 > 2,3 2 > 3
Fourth factor: communication (6 items; 42 points)	33.48 ± 4.76	30.18 ± 5.14	26.35 ± 5.75	42.43***	1 > 2,3 2 > 3
All items (37 items; 259 points)	190.92 ± 26.51	173.62 ± 25.22	149.96 ± 26.06	45.88***	1 > 2,3 2 > 3

***p < .001.

Two subjects did not answer this question.

Note. M = mean, SD = standard deviation.

interests among members,” “role clarification,” and “collaborative leadership” were included under “strength of teams” in the present study. The results of our study also suggest that “strength of teams” is an important element to enhance interprofessional collaboration.

The second factor, “management of collaborative systems,” consisted of fields related to information (measures to cope with information leakage), the effects of collaboration (establishment of interprofessional teams, procedures for collaboration, and methods for the assessment of collaboration), utilization of social resources, and contribution to the community. Some of these items are similar to “community linkages and coordination of care,” the assessment item adopted by the CPAT [10]. To improve the quality of the functions of collaboration, it is necessary to reflect on what has been learned from collaboration in the community through cooperation with community residents and effectively utilize the community’s social resources.

The third factor, “effects of collaboration,” consisted of the fields related to the interests of care recipients (most appropriate support centered on care recipients and their satisfaction) and the effects of collaboration (including appropriate support, addressing problems experienced by professionals, and self-reflection by professionals and their improvement). The field of care recipients’ interests is considered to be one aspect of “patient involvement,” item included in the CPAT [10]. Certain features of “the effects of the improvement of members of interprofessional teams” have been adopted by the partnership self-assessment tool developed by Weiss et al. [11]. This suggests that the IPC scale developed in this

study can assess the effects of interprofessional collaboration on both the users of healthcare services and health professionals.

The fourth factor, “communication,” consisted of the fields of communication and relationships (including the exchange of opinions and efforts to maintain communication) and information (including information sharing). “Communication” is a core competency for interprofessional collaboration [4]. The importance of team climates or interactions among team members and communication for interprofessional collaboration has also been pointed out [12]. Moreover, “communication” has been suggested to be an important aspect for the assessment of collaborative functions in home health care for the frail elderly in the community by the IPC scale developed in the present study. Assessment items “partnership” from AITCS [9] and “communication and information exchange” from CPAT [10] are similar to “communication” factor in the assessment index developed in the present study. However, the AITCS [9] consists of a large number of items, whereas the IPC scale developed in the present study can intensively and simply assess the functions of interprofessional collaboration.

The sum of scores for the six items of the communication factor in the cities/wards group was significantly smaller than that in the towns/villages. This suggests that it is necessary to promote communication among health professionals to improve collaboration among those living in large cities. Healthcare and educational institutions have paid attention to methods for the improvement of skills to communicate with other professionals [18,19]. Although meeting people in person is important as a communication

method, it is often difficult for all members of an interprofessional team working in a large city to meet to discuss matters face to face. Therefore, it is necessary to develop effective communication methods using information and communication technology.

Enhancing interprofessional collaboration is an important issue facing many countries today. Various nations seek to develop indices to assess interprofessional collaboration and its competency. Since the necessary collaboration would vary depending on the supply and demand of health care or on each country's healthcare system, it is essential to create indices that reflect such differences. The attitudes and values required of team members may also differ depending on each occupation's role, education, and culture.

The Norwegian version of the interprofessional collaborative competency attainment survey (ICCAS) [20] was developed, and its validity was confirmed [21]. Thus, ICCAS has been translated and used in many countries. ICCAS comprises five areas: communication, collaboration, roles and responsibilities, a patient-centered approach, and conflict management and team functioning [21]. In addition, the Italian version of the Chiba Inter-professional Competency Scale (CICS29) [22] was created, and its validity was confirmed [23]. CICS29 consists of six areas: attitude and belief, team management, actions, respect for patients, improved team cohesion, and role [22].

The IPC scale is similar to ICCAS and CICS29 concerning evaluating the organizational strength as a collaborative team, members' roles, and communication. However, the IPC scale differs from them in that it emphasizes whether collaboration is conducive to providing support to the elderly so that they would be able to maintain their preferred ways of community life. Thus, rather than solving immediate problems that are the subjects' primary concerns, it evaluates the attitudes of team members as they work with the subject to consider countermeasures jointly. In addition, the IPC scale emphasizes the process of collaboration in conducting the evaluation. This is because collaborative teams seek to support the frail elderly and become a new resource for the local community.

The IPC scale was developed with the cooperation of Japanese care managers. Thus, its validity must be confirmed before using it in other countries. However, the authors believe that it will also be helpful to evaluate the collaboration of care teams outside Japan as they help the frail elderly maintain their home life.

Most of the previous indices for the assessment of interprofessional collaboration were designed to assess general collaborative teams, and they often include items unnecessary for the assessment of collaborative functions required to provide home health care to the elderly. Furthermore, they have an excessive number of items or can only assess limited fields. The IPC scale developed in this study, which is specialized for the assessment of the functions of interprofessional teams that provide home health care for the frail elderly living in the community, only has a small number of items and can comprehensively assess collaborative functions required for home health care.

Study limitations and challenges

The response rate to the present survey was 28.7%, and the subjects may have only included those who were interested in professional collaboration. Furthermore, as the reliability and validity of the assessment index were supported by care managers, it is necessary to examine whether or not the index can be used by other professionals. This survey was conducted in 2017. Thus, it is necessary to conduct another survey to validate the results of this survey and confirm the factor structure.

A longitudinal assessment of collaborative functions using the IPC scale in the homes of the frail elderly living in the community in

need of health care will be conducted. A comparison of the functions of interprofessional teams in Japan and other countries will also help improve the quality of interprofessional collaboration in many different countries.

Conclusions

The new IPC scale for the assessment of the functions of interprofessional collaboration to provide home health care for the frail elderly living in the community consists of four factors: "strength of teams," "management of collaborative systems," "effects of collaboration," and "communication," comprising 37 items in total. This scale indicated that the reliability and validity were good. It is easy to implement the factors of IPC. This scale can be used to assess the IPC for home health care for frail elderly.

Consent for publication

The authors and participants all consent to the publication of the article.

Ethics approval and consent to participate

This study was approved by Medical Ethics Committee of Kanazawa University (No. 751). Participation was voluntary, and submission of a completed questionnaire form was regarded as consent to participate in the study. The subjects consented to participate in the interviews and pilot surveys in written form. The data of the participants were kept confidential and used for the academic research only.

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Conflict of interest

The authors declare no conflict of interest.

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