Fuzzy Analysis for Quality Improvement of Evaluation Index Inlong-Term Care Institutions for the Elderly in Korea

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Abstract: This study improved the quality of the evaluation index via. fuzzy analysis of the evaluators and the evaluators of the elderly care facilities. The 2018 survey was conducted by 19 evaluation experts (evaluators and assessors) for elderly nursing facility in January 2019. The main results, first, compliance with facility standards may be deleted as it is an indicator to be determined at the time of establishing an elderly nursing home. Second, emphasized the rights of recipients not the difference in weight between sub-indicators. Third, utilization and exchange of community resource's is a low priority, however, it should be used as an evaluation index to provide various services for the elderly residents. Fourth, 'provision process' requires additional factors such as 'end care' rather than deletion of evaluation factors because each index is related to the service provided to the elderly. 'Benefit provided result's cannot replace the six evaluation factors and apparently some degree of correction is needed.

Key words: Long-term care insurance system, elderly care facilities, evaluation index, fuzzy analysis, South Korea, community resources

INTRODUCTION

In Korea, the long-term care insurance system for the elderly has been implemented to address the needs of the increasing elderly population and the weakening of family support function. It aims to improve the quality of life among the elderly and their families via. social co-care system. Quality management of the service is important for the successful operation of the system. As a result, the need to maintain the quality of long-term care services and the rights of consumers in long-term care services are being evaluated (Lee, 2016).

Long-term care services are covered for the elderly population aged 65 years or older or persons with geriatric disease under 65 years of age. Based on the long-term care recognition score that indexed "how much help (long-term care) is needed in everyday life depending on the state of mind and body function", the types of benefits are divided into elderly care facilities (facility benefits), home welfare facilities (visit care, day and night care, short-term care and visiting bath) and welfare equipment and special cash benefits (family allowance). In this study, we focused on the evaluation index of elderly care facilities. The elderly nursing facility is a residential system which supports physical activity of the elderly who are admitted, provides education and training for the

maintenance and improvement of physical and mental functions and is divided into elderly nursing and community living facilities (NHIS., 2019).

Assessment of elderly care facilities is conducted every 3 years based on Article 54 of the long-term care insurance for the elderly (2015 evaluation cycle changed from 2-3 years). In 2009 and 2010, the evaluation was conducted only for the hope institutions. Since, 2011, the system was introduced under the mandatory evaluation system and a total of five evaluations were conducted until 2018 (NHIS., 2019). The National Health Insurance Corporation (NHIC) is responsible for the evaluation of elderly care facilities and is based on the evaluation index developed for each type of benefit. The evaluation index includes major and middle categories and evaluation factors and items. In 2009, 2011, 2013 and 2015, 106, 98, 98 and 88 items were evaluated. The current evaluation index (2018) was significantly reduced to 48 items (without distinction between evaluation factors and items)

The elderly care facility evaluation index was constructed based on the framework of structure process performance which affects the service quality. The evaluation index was also subdivided and was difficult to highlight the role of important evaluation factors or underscore the importance of each question. In addition,

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the proportion of this area was low in the 2015 evaluation index compared with the recent evaluation based on the user center and the service result (Lee, 2016).

Accordingly, in 2016, there was a public hearing regarding the revised evaluation system of long-term care facilities for the elderly. In the 2016 public hearing, we proposed an evaluation index that greatly reduced the five major categories (institutional operation, environment and safety, guarantee of user rights, benefit provision process and benefit provision result) and 33 evaluation items (Lee, 2016). Thereafter, the evaluation index was revised to include five major categories, 13 middle classifications and 48 evaluation factors to reflect the results of public hearings. In the 2018 evaluation, the observation index was newly established, the interview index for the elderly was expanded and the area of 'rights and responsibilities' was changed to the area of 'recipient rights guarantee', thereby strengthening the rights of recipients (NHIS, 2017).

Many studies related to the social movements of evaluation were published in academia. Specifically, four to five studies (Choi *et al.*, 2012; Lee *et al.*, 2012; Lee *et al.*, 2013; Paik *et al.*, 2015) including the development and improvement of evaluation indicators and related studies were published with a few differences from the National Health Insurance Corporation's evaluation index. Unfortunately, the previous studies failed to analyze or revise the current evaluation index by developing and proposing a new evaluation index according to their expertise.

This study aims to improve the quality of the evaluation index via. Fuzzy analysis of the evaluators of the elderly care facilities. The results of this study will be reflected in the 2021 evaluation index of the elderly which is expected to provide practical assistance for the evaluation of elderly care facilities.

MATERIALS AND METHODS

Subject and data collection procedures: The 48 evaluation factors used in 2018 were ranked for the appropriateness of the indicator (highly fit~not at all) and the degree of confidence in the conformity assessment (very reliable~very uncertain) using a 5-point Likert-type scale.

The survey was conducted during the period January 15-30, 2019 targeting experts (evaluators and assessors) who are experienced in evaluating elderly care facilities in 2018. A total of 19 out of 22 samples was collected and used for analysis.

Analysis: In this study, fuzzy analysis was used to modify and supplement the evaluation index based onpriority. Fuzzy theory was proposed by Zadeh in the mid-1960s as an alternative to existing decision-making methods. In order to solve the ambiguous expression used by human beings (Shin *et al.*, 2014), the fuzzy set recognizes the ambiguity of the analysis standard and applies the membership concept to quantify the degree of ambiguity. All information was flexibly and precisely determined by assigning a functional value of the membership rangingbetween 0 and 1 (Koo and Sung, 2001; Lee, 2000).

RESULTS AND DISCUSSION

Table 1 summarizes the results of the fuzzy analysis for the index of elderly care facilities in 2018. The analysis of the middle category was not conducted separately and the factors for the evaluation of each classification are shown in Table 2 through 6.

Fuzzy analysis of 'major category': The experts found that "environment and safety" was the most important of the five sub-categories under 'major category' in the 2018

Table 1: fuzzy analysis of the evaluation index

Major/middle categories	Evaluation factors	Fuzzy analysis result (ranking)	
		Major	Evaluation factors
Institution operation			
Institution management	Operational regulations	3	5
	Operational planning and evaluation		6
	Steering committee		4
Human resource management	Manpower standard		2
	Additional staffing		9
	Percentage of experienced workers		10
	Human resource development		8
	Health screenings		3
	Employee healthcare		1
	Improve employee welfare		7
Resource uses	Utilization and exchange of community resources	11	
Environment and safety			
Facility and facilities management	Facility standard	1	11
	Special bedroom		12

Table 1: Fuzzy analysis of the evaluation index

		Fuzzy analysis result (ranking)	
Major/middle categories	Evaluation factors	Major	Evaluation factors
	Safe and pleasant environment		9
	Creating a fall prevention environment		8
Hygiene and infection management	Food hygiene management		1
	Infection control activity		2
	Infection control		5
Safety management	Firefighting equipment		6
	Electric gas facility		3
	Disaster response		7
	Emergency response		4
	Night protection		10
Recipient rights guarantee			
Recipient rights	Guarantee of recipient's right to know	2	3
	Strengthening participation of recipients (guardians)		4
	Recipient dignity		
	Ensuring dignity and privacy		1
	Elderly human rights protection		2
Benefit provided process			
Benefit initiation	Integrated ejaculation	4	8
Benefit plan	Benefits plan creationand administration		10
Benefits provided	Evaluation of benefits		9
	Case management		11
	Cleanup service for recipients		1
	Meals served		2
	Excretion management		4
	Prevention of pressure ulcers		3
	Pressure ulcer management		7
	Nursing and medical services		6
	Medication and drug administration		5
	Function recovery training		14
	Physiotherapy		13
	Cognitive function promotion service		15
	Leisure activity services		12
Benefit provided results			
Recipient status	Rating status	5	6
	Pressure ulcer status		2
	Intubation catheter status		1
	Excretion function status		3
Satisfaction rating	Cable satisfaction		5
	Evaluator comments		4

Table 2: Fuzzy analysis of major category

Major category	Weight	Ranks
Environment and safety	0.2217	1
Recipient rights guarantee	0.2131	2
Institution operation	0.2038	3
Benefit provided process	0.1967	4
Benefit provided results	0.1647	5

index of elderly care facilities, followed by 'guarantee of the right of recipient'. 'Salary result' occupied the lowest rank at number 5 (Table 2).

Fuzzy analysis of evaluation factors under 'environment and safety': The experts ranked 'food hygiene management' at the top for the 13 evaluation elements under 'environment and safety' followed by 'infection control activity', 'Electric gas facility', 'Emergency response' and 'infection control' . By contrast, the lowest weight was assigned to 'facility standard' and 'special bedroom' (Table 3).

Table 3: Fuzzy analysis of evaluation factors under 'Environment and safety'

Evaluation factors under 'environment and safety'	Weight	Ranks
Food hygiene management	0.0848	1
Infection control activity	0.0844	2
Electric gas facility	0.0830	3
Emergency response	0.0825	4
Infection control	0.0824	5
Firefighting equipment	0.0818	6
Disaster response	0.0798	7
Creating a fall prevention environment	0.0794	8
Safe and pleasant environment	0.0776	9
Night protection	0.0762	10
Facility standard	0.0727	11
Special bedroom	0.0565	12

Fuzzy analysis of evaluation factors under 'recipient rights guarantee': The experts gave the highest weight to 'ensuring dignity and privacy' and the lowest weight to 'strengthening participation of recipients (guardians)' among the four evaluation items included in the 'recipient rights guarantee' underthe major category (Table 4).

Table 4: Fuzzy analysis of evaluation factors associated with 'recipient rights guarantee'

Evaluation factors of 'recipient rights guarantee'	Weight	Ranks
Ensuring dignity and privacy	0.2624	1
Elderly human rights protection	0.2615	2
Guarantee of recipient's right to know	0.2554	3
Strengthening participation of recipients (guardians)	0.2207	4

Table 5: Fuzzy analysis of evaluation factors under 'institution operation'

Evaluation factors of 'institution operation'	Weight	Ranks
Employee healthcare	0.1089	1
Manpower standard	0.1070	2
Health screenings	0.1068	3
Steering committee	0.1065	4
Operational regulations	0.1060	5
Operational planning and evaluation	0.1035	6
Improve employee welfare	0.1004	7
Human resource development	0.0893	8
Additional staffing	0.0885	9
Percentage of experienced workers	0.0830	10
Utilization and exchange of community resources	0.0588	11

Table 6: Fuzzy analysis of evaluation factors under 'benefit provided process'

Evaluation factors of 'benefit provided process'	Weight	Ranks
Cleanup service for recipients	0.0728	1
Meals served	0.0725	2
Prevention of pressure ulcers	0.0719	3
Excretion management	0.0711	4
Medication and drug administration	0.0709	5
Nursing and medical services	0.0707	6
Pressure ulcer management	0.0700	7
Integrated ejaculation	0.0688	8
Benefits evaluating results	0.0686	9
Benefits plan establish and provide	0.0682	10
Case management	0.0609	11
Leisure activity services	0.0609	12
Physiotherapy	0.0607	13
Function recovery training	0.0603	14
Cognitive function promotion service	0.0515	15

Fuzzy analysis of evaluation factors underlying 'institution operation': The experts ranked 'employee healthcare' the highest among the 11 items of 'institution operation' followed by 'manpower standard', 'health screenings', 'steering committee' and 'operational regulations'. In addition, 'additional staffing', 'percentage of experienced workers' and 'utilization and exchange of community resources' were accorded the lowest weight (Table 5).

Fuzzy analysis of evaluation factors under 'benefit provided process': The experts gave the highest weight to the 'cleanup service for recipients' among the 15 evaluation items included in the 'benefit provided process'. Next, weights were assigned in the following order: 'meals served', 'prevention of pressure ulcers', 'excretion management', 'medication and drug' administration' and 'nursing and medical services'. The 'cognitive function promotion service' was assigned the lowest weight (Table 6).

Table 7: Fuzzy analysis of evaluation factors under 'benefit provided results'

Evaluation factors of ' before Benefit provided results'	Weight	Ranks
Intubation catheter status	0.1792	1
Pressure ulcer status	0.1740	2
Excretion function status	0.1716	3
Evaluator comments	0.1656	4
Cable satisfaction	0.1556	5
Rating status	0.1540	6

Fuzzy analysis of evaluation factors associated with 'benefit provided results': The experts assigned the highest weight to the 'Intubation catheter status' sub-category among the six evaluation items included under 'benefit provided results'. Next, weights were assigned in the order of 'bath pressure ulcer status' and 'excretion function status'. By contrast, 'rating status' was assigned the lowest weight (Table 7).

This study improved the quality of the evaluation index via. Fuzzy analysis of the evaluators and the evaluators of the elderly care facilities. The 2018 survey was conducted by 19 evaluation experts (evaluators and assessors) for elderly nursing facility in January 2019 The main results are summarized as follows with suggestions to improve the quality of the evaluation index.

First, 'environmental and safety', one of the major categories, scored 25 points out of a total of 100 points which was one higher than the 2015 evaluation index. As the social importance of safety has become more prominent, it has also been recognized by facility evaluation experts that 'environment and safety' was important to improve the quality of life inelderly living in long-term care facilities because of dementia, chronic diseases and discomfort.

Second, the fuzzy analysis of 'safety and environment' showed that night-time protection, facility standards and special bedrooms plated a minor role and were assigned alow weight. In particular, compliance with facility standards may be deleted as it is an indicator to be determined at the time of establishing an elderly nursing home. Also, the special bedrooms may not be appropriate based on the diseases and degree of disability in the elderly and the standards stipulated for the elderly nursing homes in Korea.

Third, the fuzzy analysis of 'recipient rights guarantee' showed that all factors were important considering the social conditions of Korea which emphasized the rights of recipients, not the difference in weight between sub-indicators.

Fourth, 'employee healthcare' ranked first in the fuzzy analysis of 'institution operation' but this factor may be deleted because it is included underthe items for supervision by the local government and related organizations. 'Percentage of experienced workers' represents the salary burden in the elderly care facilities.

In addition, since, the quality of service for the elderly is not high due to long working hours in the same institution, it is recommended fordeletion. However, 'utilization and exchange of community resources' is a low priority; however, it should be used as an evaluation index to provide various services for the elderly residents.

Fifth, the fuzzy analysis of 'provision process' requires additional factors such as 'end care' rather than deletion of evaluation factors because each index is related to the service provided to the elderly. Evaluation index of procedures required by resident elderly person towards the end of life needs to be included because in many cases the elderly end up living in a nursing home due to disease aggravation or aging.

Finally, 'benefit provided results' comprised improvement of the elderly medical care grade, evaluation of the elderly caregivers' satisfaction with their services and evaluators' opinions. This is one of the most important purposes of evaluating elderly care facilities. Nevertheless, the experts rated the importance of "benefit provided results" the lowest similar to the unrealistic evaluation index discussed by Kim and Lee (2019) which is difficult to manage and supervise in institutions. For example, the health status of the elderly who have been classified as a health challenge and admitted to an elderly care facility may be worse than maintenance or improvement. Therefore, it was suggested that factors such as 'whether elderly long-term care status is maintained or improved after entering the facility' was not suitable as an institutional evaluation index.

CONCLUSION

However, the improvement of the quality of life in the elderly was facilitated by implementing a long-term care insurance system and the subjective satisfaction and quality of life of the users also constitute a key index in the performance-based quality management (Donabedian, 1980). Therefore, 'benefit provided results' cannot replace the six evaluation factors and apparently some degree of correction is needed. Therefore, it is suggested that it is reasonable to delete 'evaluator comments' and 'cable satisfaction' which involve subjectivity and to delete 'rating status' which does not reflect reality. Above all, 'rating status' is confirmed by the data of National Health Insurance Corporation and therefore, it is not valid as an index of institutional evaluation.

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