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Original Article

Reliability and validity of Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care

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Key words

nursing practices, diabetes, interdisciplinary team care, questionnaire, reliability and validity

Abstract

Purpose: The purpose of this study was to evaluate the reliability and validity of *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care*.

Methods: Subjects of this study were nurses engaged in patient care at Japan Diabetes Society (JDS) educational facilities for doctors and facilities employing certified diabetes nurses. A self-administered questionnaire was employed in this study. The questionnaire included 25 items covering nursing practices in interdisciplinary team care for diabetes. Validation of the team scale items was done with the social skill scale and the critical thinking disposition scale. Item and factor analysis were employed to examine data, Cronbach's alpha coefficient was used to estimate internal consistency reliability, and Spearman's rank-order correlation coefficient was used to examine criterion-related validity.

Results: Out of 1,115 replies received, 848 responses were valid (76.0%). Subjects were 819 (96.6%) females, mean age was 38.5±9.5, mean year of experience in nursing care for diabetes was 6.8±5.5. All 25 items were explained by four-factor structure through factor analysis. Alpha coefficient was 0.95 for 25 items. In terms of correlation with external standards, r=0.51 for the total scores of 25 items and scores in the social skill scale, and r=0.52 in the critical thinking disposition scale scores.

Conclusion: Construct validity and internal consistency reliability were confirmed. Correlation was observed between the two scales used as external standards, which confirmed criterion validity. The results demonstrate the reliability and validity of this questionnaire.

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Introduction

In Japan, diabetes patients are gradually increasing, with 3.166 million people[1], and the proportion of those with strongly suspected diabetes are 19.5% for males and 9.2% for females according to the National Health and Nutrition Survey in 2015[2]. Diabetes has been said to be a national disease for Japanese, for that reason, we have to educate patients to continue desirable treatment in order to prevent complications and to ensure the quality of life. To that end, diabetes team medical care of multi-occupational collaboration has been promoted, and it is suggested that the key element is the nurse who is the closest existence for patients.

In 2000, the Certified Diabetes Educators of Japan (hereafter referred to as "CDEJ") system was introduced to enhance the involvement of medical staff such as nurses, pharmacists, nutritionists, clinical technologists, and physical therapists in patient education. As of 2017, the number of CDEJ-certified individuals are more than 19,300[3]. Recognizing the importance of specialists in a wide range of fields working as a team to provide diabetes care, the Ministry of Health, Labour and Welfare (MHLW) has authorized diabetic dialysis prevention guidance and management provided by CDEJ-certified individuals under the medical care system[4].

Nurses play a significant role in enhancing team care for diabetes patients. Team care involves the sharing of problems encountered by individual patients and their families among specialists and the provision of specialized knowledge and techniques with the goals of improving QOL in both patients and families, and maintaining patient motivation for treatment[5,6]. In addition to pharmacotherapy, balanced diet and exercising habit are considered important in the control and treatment of diabetes. Nurses try to understand the physical, psychological, and social aspects of treatment, and provide special care for both patients and their families with the goal of improving QOL. The role of nurses in team care for diabetes patients is significant, and it is important that nurses' ideas and decisions are based on the perspective of patients and their families. An ideal team care for diabetes patients requires not only that nurses cooperate as a team, but that they also consciously apply their unique perspectives and methods to enhance team care. With this in mind, we created *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care*, the questionnaire was based on 25 items that represented aspects of enhanced team care for patients with diabetes[7,8].

The Interdisciplinary Education Perception Scale (IEPS)[9] was established in the US as a tool to measure awareness and cooperation among specialists in different areas of healthcare. While the IEPS has been utilized to evaluate education for students of the health profession[10,11], there existed no tool for the evaluation and improvement of team care in Japan. To address this shortcoming, we established the questionnaire for nurses engaged in interdisciplinary team care for diabetes patients, a tool developed for the evaluation of nursing care in Japan.

We intended to evaluate the reliability and validity of the questionnaire through nurses who were nursing for diabetes patients at institutions in Japan.

Methods

1. *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care* Development Process

We extracted 20 items from the previous study, which was conducted for experienced nurses in team care for diabetes to extract seven roles of nurses in team care[12], to create a draft of the *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care* with the 20 items. Then, a draft with 26 items was created utilizing the opinions of 149 certified nurses who were skilled in diabetes care[7]. Afterwards, a survey on the level of agreement of 158 skilled nurses in diabetes care about each item in the draft was conducted, content validity was completed in reference to the Lynn's content validity quantification method[13-15], and finally a questionnaire of 25 items[8] was completed.

2. Subjects

Subjects of this study were nurses engaged in patient care at Japan Diabetes Society (JDS)

educational facilities for doctors and facilities employing certified diabetes nurses. Sampling design was convenient, with institutions distributing questionnaire to the nurses there.

3. Data collection period

Data collection took place between March and May 2013.

4. Survey method

1) Data collection method

A self-administered questionnaire was employed in this study. Nurse managers at 770 subject facilities were invited to participate in the study and questionnaires were sent to the chief nurses of 223 facilities who expressed their willingness to cooperate (response rate at the institutional level was 28.9%). The nurse managers were asked to distribute the questionnaire to individual nurses. Nurses were asked to send their responses to researchers.

2) Number of collected and valid responses

The questionnaires were distributed to 2,294 nurses, and 1,115 (48.6%) answer sheets were received in response, of which 848 (76.0%) provided responses to all 25 questionnaire items designed to confirm reliability and validity, and to all items of two scales designed to evaluate concurrent validity, and attributes.

3) Questionnaire contents

(1) Demographic characteristics

The following information was collected: gender, age, academic record, years of nursing experience, years of experience in diabetes nursing care, CDEJ certification, diabetes nurse certification, ranks, number of beds at individual facilities and location of facilities.

Subjects were 819 (96.6%) females, mean age was 38.5 ± 9.5, mean year of experience in nursing care for diabetes was 6.8 ± 5.5, 330 subjects (38.9%) had CDEJ certification, 71 were certified diabetes nurses (8.4%), and the rank of 590 subjects was staff (69.6%). The details are shown in Table 1.

(2) The 25 items included in the *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care*[8]

Responses were provided on a 5-point scale from "1: Does not apply" to "5: Applies." A higher total score represents higher level of nurse's awareness and skill in promoting team care for diabetes.

(3) Questionnaire for concurrent validity evaluation

Nurses are required to have ability to establish desirable communication with patients, their families, and other staff to coordinate team care concurrently. Also, nurses need to have the ability to perceive the physical, psychological, and social conditions of patients and their families as well as the practices of other staff to make objective decisions for team care. To confirm concurrent validity, social skills were evaluated using a scale established by Higuchi et al.[16], while critical thinking disposition skills were evaluated using a scale established by Hirayama et al.[17].

① The 27 items included in the social skill scale[16]

The 27 items were selected as an external standard to assess concurrent validity. This social skill scale was developed by Higuchi et al.(2004) as scale of social skills required to promote self-development of the recipients of human services and to prevent complacency in the providers thereof. This social skill rating scale includes 14 items related to the ability to increase self-reliability and 13 items related to the ability to express affection. The reliability and validity of the scale were previously confirmed. It was concluded that these social skill scale items would help in the evaluation of nurses' ability to communicate and coordinate with patients, their families, and other specialists. The responses were provided on a 5-point scale from "1: I never do" to "5: I always do." A higher total score represents higher level of social skill.

② The 33 items included in the critical thinking disposition scale[17]

The critical thinking ability scale was also used as an external standard to assess concurrent validity. To ensure the appropriate selection and utilization of the information, it is important to have critical thinking ability, the ability to perceive things objectively, to examine them multilaterally, and to make decisions based on appropriate standards. This critical thinking

Table 1　Attributes of the nurses

(n=848)

Attribute Classification		Number of respondents (nurses)	Rate (%)
Gender	Male	29	(3.4)
	Female	819	(96.6)
Age (mean ± standard deviation : 38.5 ± 9.5)	20～29	186	(21.9)
	30～39	268	(31.6)
	40～49	267	(31.5)
	50～59	123	(14.5)
	60 < (years)	4	(0.5)
The number of years involved in diabetes education (mean ± standard deviation : 6.8 ± 5.5)	< 3	192	(22.6)
	3 ≥ n < 5	161	(19.0)
	5 ≥ n < 10	255	(30.1)
	≥ 10 (years)	240	(28.3)
Certified Diabetes Educators of Japan (CDEJ)certification	Certified	330	(38.9)
	Uncertified	518	(61.1)
Certified diabetes nurses	Certified	71	(8.4)
	Uncertified	777	(91.6)
The post and rank	Chief nurses	56	(6.6)
	Associate chief nurses	187	(22.0)
	General staff	590	(69.6)
	Other	15	(1.8)
Location of individual facilities	Hokkaido	40	(4.7)
	Tohoku	79	(9.3)
	Kanto	183	(21.6)
	Chubu	167	(19.7)
	Kinki	166	(19.6)
	Chugoku	51	(6.0)
	Shikoku	63	(7.4)
	Kyushu (contained Okinawa)	99	(11.7)

disposition scale was developed by Hirayama et al.[17] to measure this. The scale consists of 13 items regarding awareness of logical thinking, 10 items regarding inquiry-mind, seven items regarding objectiveness, and three items evidence based judgment. The reliability and validity of the scale were confirmed. It was concluded that these critical thinking disposition scale items would help us to evaluate nurses' ability to objectively grasp the physical, psychological and social condition of patients and their families, and the response of other specialists. The responses were provided on a 5-point scale from "1: Does not apply" to "5: Applies." A higher total score represents higher critical thinking ability.

5. Analytical method

1) Examination of construct validity

The ceiling and floor effects were assessed, and item-total correlation analysis (I-T correlation analysis) was conducted.

Exploratory factor analysis to assess the factor structure for the 25 items was conducted.

To confirm the known group validity, the questionnaire scores of the groups with abundant experience in diabetes nursing care were compared to the scores of those without.

2) Examination of internal consistency reliability

Cronbach's alpha coefficient in each item for each factor and in all items was calculated.

3) Examination of concurrent validity

Correlation was assessed for the 25 items selected in this study, 27 social skill scale items and 33 critical thinking disposition scale items utilizing Spearman's rank-order correlation coefficient to confirm concurrent validity[14].

Nurses were also classified into higher and lower groups of total scores, mean value for

each item in each group was calculated, and was compared through good-poor analysis (G-P analysis).

Significance was set at $p<0.05$, and statistical processing was conducted with SPSS ver. 19.0.

6. Ethical considerations

Approval was obtained from our University Ethical Committee (Approval No. 434). The questionnaire was anonymous. Neither facilities nor individuals were identifiable. Subjects who returned questionnaire responses consented to participation in this study.

Results

1. Construct validity

1) Item analysis

Neither ceiling nor floor effects were observed. All I-T correlation analyses were between r=0.42 and r=0.62. None of the questionnaire items revealed inconsistency, and we conducted factor analysis on all 25 items.

2) Factor analysis

Factor analysis[18)19)] was conducted utilizing the maximum-likelihood estimation and promax rotation. Kaiser-Meyer-Olkin measure of sampling adequacy was 0.95, and Bartlett's test of sphericity was significant, which showed that factor analysis would be appropriate. The data was analyzed, whose factors had an eigenvalue larger than 1 and a factor loading larger than 0.4, and 25 items and four factors were extracted. The cumulative contribution ratio before rotation was 63.9%.

These items and factors were:13 items related to the first factor (*expressing opinions to the team from the perspective of a nurse*), four items related to the second factor (*providing assistance to patients considering their physical and psychological conditions and lifestyle*), four items related to the third factor (*being aware of the need to include patients and their families in the team*), and four items related to the fourth factor (*respecting one another and improving as a team*). The details are shown in Table 2.

3) The known group validity

To confirm the significance of the high scores of the qualified group and the experienced group, an independent T-test was conducted, using the presence or absence of CDEJ certification, the presence or absence of Certified Diabetes Nurse certification, and whether diabetes nursing experience was more or less than 5 years as the independent variables, and using the total scores of the 25 questionnaire items and the average of the lower scale scores of the four factors in the 25 items as the dependent variables. The results showed that the scores were significantly higher in both the qualified group and the experienced group ($p<0.001$).

2. Criterion-related validity

1) External standards

The total scores of the 25 items in the *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care* revealed correlation with social skill scores (r=0.51) and critical thinking disposition scores (r=0.52). The lower scale scores of the four factors in 25 items revealed correlation with social skill scores (r=0.38－0.48) and critical thinking disposition scores (r=0.33－0.51). (Table 3)

2) Discriminant validity

For G-P analysis, the mean scores of the 25 items (an average of 88.9 points by counting the total of the 25 items) were calculated to classify subjects into a higher score group and a lower score group, and T-tests were performed for the scores of each item in the questionnaire. As a result, mean score for all questionnaire items in the higher score group was significantly higher than that in the lower score group, which confirmed the questionnaire's high discriminating power.

3. Internal Consistency Reliability

Cronbach's alpha coefficient in all 25 items was 0.95. The alpha coefficient in the four lower scale scores was between 0.84 and 0.92.

Discussions

Based on previous qualitative analyses of interviews with nurses involved in Interdisciplinary team care for diabetes patients, 25 items were extracted for use in the nursing practice questionnaire, and content validity was confirmed twice with certified nurses who were skilled in diabetes care[8)]. All 25 items were explained by

Table 2　Factor loadings of the 25 items included in the Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care

Factor / item	1	2	3	4
Factor 1 : Expressing opinions to the team from the perspective of a nurse (Cronbach's alpha= 0.927)				
When nursing care made good changes in patients, I share the contents with other professionals in an objective manner.	**0.825**	−0.069	−0.096	0.048
I provide information on nursing skills that can be used by other professionals for patient education.	**0.799**	−0.143	−0.003	0.009
I share my ideas as a nurse with other professionals.	**0.716**	0.122	−0.088	0.015
I try my best to have doctors recognize my nursing ability.	**0.619**	0.255	−0.154	0.023
When conflicting opinions with other professionals arise, I place a priority on patient safety and peace of mind, and try to coordinate opinions respecting the standpoint of the other professionals and maintain balance in the team.	**0.565**	−0.019	0.035	0.234
I respect the thoughts and lifestyle of diabetes patients and share information in the team.	**0.521**	0.186	0.21	−0.07
I try to develop team care for diabetes patients from the standpoint of the patient.	**0.493**	0.165	0.162	0.01
I actively support patients by expressing opinions to team members on their behalf.	**0.487**	0.183	0.08	0.036
I actively try to acquire knowledge and skill from other professionals.	**0.468**	0.06	−0.111	0.299
I try to work with individuals engaged in departments and divisions other than the team to facilitate the activities of the team within the organization.	**0.452**	−0.144	0.432	−0.007
I try my best to vitalize team activities.	**0.429**	−0.047	0.275	0.155
I try to help diabetes patients live healthier and more secure lives, and share individual patient's goals with team members, including patients' families.	**0.423**	0.133	0.312	−0.121
I try to maintain good communication with doctors and establish trusting relationships.	**0.417**	0.338	−0.107	0.097
Factor 2 : Providing assistance to patients considering their physical and psychological conditions and lifestyle (Cronbach's alpha=0.878)				
I try to respond to patients' questions, provide support to solve their problems in order to gain patient trust.	−0.104	**0.835**	0.009	0.083
I try to look at situations from the patient's point of view and provide care with professional judgment.	0.041	**0.817**	−0.041	−0.018
I try to understand the physical and the psychological conditions of patients and work together with them.	0.02	**0.772**	0.066	−0.028
I imagine life as a diabetes patient and help them to express their feeling to medical professionals.	0.001	**0.747**	0.041	−0.006
Factor 3 : Being aware of the need to include patients and their families in the team (Cronbach's alpha=0.845)				
Team members maintain their awareness of the need to cooperate with other team members, including patients and their families.	−0.229	0.032	**0.852**	0.157
Team members consider patients and their families as equal members of the team.	−0.117	0.04	**0.822**	0.046
Each team member tries hard to exercise his or her maximum strength for patients considering the patients and their families as team members.	0.155	−0.052	**0.611**	0.132
Team members work with patients' families to promote their understanding of life with diabetes and ask them to perform necessary roles.	0.388	0.062	**0.507**	−0.188
Factor 4 : Respecting one another and improving as a team (Cronbach's alpha=0.847)				
I respect other team members and try to establish trusting relationships.	−0.153	0.092	0.104	**0.848**
I tell members when team care has changed patients' conditions for the better, and share the pleasure of this to motivate the team.	0.094	0.009	0.061	**0.686**
When I feel any team member's proficiency and growth as a professional, I always mention it to that member.	0.247	−0.05	0.029	**0.576**
I consider the individual workload when we share work in the team.	0.194	−0.036	0.044	**0.503**
variance explained	11.97	1.71	1.18	1.11
proportion of variance explained	47.89	6.86	4.73	4.43
cumulative proportion of variance explained	47.89	54.75	59.48	63.92

Correlations among factors	1	2	3	4
1	1.00	.705	.700	.670
2		1.00	.548	.527
3			1.00	.642
4				1.00

Cronbach's alpha for the total score was 0.954.

Table 3 Spearman's rank-order correlation coefficient with "Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care" and social skill scale as well as critical thinking disposition scale

Nursing Practice Indices in Team Care for Diabetes	Social Skill Scale	Critical Thinking Disposition Scale
Factor 1 : Expressing opinions to the team from the perspective of a nurse (13 items)	0.48**	0.49**
Factor 2 : Providing assistance to patients considering their physical and psychological conditions and lifestyle (4 items)	0.44**	0.51**
Factor 3 : Being aware of the need to include patients and their families in the team (4 items)	0.38**	0.33**
Factor 4 : Respecting one another and improving as a team (4items)	0.42**	0.44**
Total 25 items	0.51**	0.52**

**p<0.01

four-factor structure through factor analysis, which confirmed construct validity. In addition, the alpha coefficient for each factor was high, between 0.84 and 0.92, and 0.95 for 25 items, which confirmed sufficient internal consistency. Each factor revealed correlation with the social skill rating scale at r=0.51 and with the critical thinking disposition scale at r=0.52, which confirmed concurrent validity. All these were statistically meaningful ($p<0.05$). These results confirmed the reliability and validity for use of this questionnaire.

The first factor was named *expressing opinions to the team from the perspective of a nurse* because items were associated with the relationship between nurses and doctors, the most important member in team care, and nurses' consideration for cooperation with team members. This factor is the most important for nurses in their involvement with team care, and it is important for them to exercise their ability considering lower items. For diabetes patients, their daily lives themselves tend to be treated as well as meals, so patients tend to feel stress in their medical treatment living. Also, the minus image of diabetes, "intolerance", makes the patients feel lonely. Patients' efforts and intentions can be hard for medical staff to notice, and patients' efforts do not necessarily lead to improvements in HbA1c levels. As a nurse, it is important to express and disseminate within the team by expressing the meaning behind the behaviors of patients[20] which is difficult to see by doctors and other occupations.

The second factor was named *providing assistance to patients considering their physical and psychological conditions and lifestyle* because the items were associated with practical nursing care taking into consideration the physical and psychological conditions of patients and their lifestyles, and establishing trusting relationships with patients. It is important for nurses to have the ability to provide care as specialists, ability that leads to appropriate team care for diabetes patients. Diabetes is a chronic disease, so nurses work with patients for a long span of time, and make efforts to gain their trust. Because diabetes treatment is closely related to lifestyle, especially including diet management, nurses have to exert their expertise to a great extent, with the role of guiding teams to support diabetes patients based on their physical and mental conditions.

The third factor was named *being aware of the need to include patients and their families in the team* because the items were associated with the nurses' awareness and approaches to the inclusion of patients and their families in team care. This study was based on the concept of including patients and their families in team care as team members. Patients need to control their physical and psychological conditions as well as lifestyle, their families need to cope with diabetes, and also healthcare providers need to

provide assistance to patients and their families utilizing their expertise. To date, diabetes has been considered to be a disease to be treated by the patients themselves. However, it is said that patients' self-care behavior improves when they receive family support[21]. In a report that observed an improvement in diabetes education when discussions between patients and their families were included in the critical path, it is suggested that family support is particularly crucial for diabetes patients[5) 6)].

The fourth factor was named *respecting one another and improving as a team* because the items were associated with characteristics of nurses' roles such as coordination among team members and educational considerations. Nurses are specialists in supporting the growth and development of individuals. Subjects of care are patients and their families; however, nurses play a significant role in coordinating among members of team care, which is reflected in patient care. Since nursing professionals have a wide range of expertise in being the closest to patients, in many cases they are responsible for coordination among different types of medical professionals. Especially in diabetes medical care, a focus on patients' lifestyles is important for treatment. Thus, the authors believe that nurses have a direct impact when efforts for patient education bear fruit[22], and sharing with team members leads to mutual respect and development among the team.

Implications

We hope that it will be possible to use this questionnaire in the future in providing the opportunity for nurses to review their role in Interdisciplinary team care for diabetes patients, and to understand their role in enhancing team care. In the future, it is also expected to be used as a training tool for nurses to set up interdisciplinary collaborative diabetes teams, or to revitalize stagnant team care. The environment and the system that allows nurses to fulfill their roles in team care need to be developed to provide desirable care for patients. Hopefully, this questionnaire will be useful for the development of an environment and system that allows nurses to enhance interdisciplinary team care for diabetes patients in Japan. Therefore, we would like to consider concrete ways to utilize this questionnaire as one tool to nurture nurses' awareness of enhancing team care in the future.

Conclusion

The data obtained from 848 nurses engaged in care for diabetes patients was analyzed to evaluate the reliability and validity of the *Questionnaire for Nursing Practices in Diabetes Interdisciplinary Team Care*. All 25 items were explained by four-factor structure through factor analysis, and internal consistency was also confirmed (α =0.95), which confirmed construct validity. In addition, each factor revealed correlation with the social skill rating scale at 0.51 and with the critical thinking ability scale at 0.52, which confirmed concurrent validity. These results suggest the reliability and validity of the questionnaire investigated in this study, and it is expected that the questionnaire in team care will be utilized in the future.

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Declaration of conflicting interests

We declare that there is no conflict of interest.

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「多職種協働糖尿病チームケアを促進する看護実践質問表」信頼性・妥当性の検証

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キーワード

看護実践，糖尿病，多職種協働チームケア，質問表，信頼性・妥当性

要　旨

目的：独自に作成した「多職種協働糖尿病チームケアを促進する看護実践質問表」の信頼性と妥当性を検証する。

方法：日本糖尿病学会糖尿病専門医認定教育施設および糖尿病看護認定看護師の所属施設に勤務し糖尿病看護に携わっている看護師を対象に自記式アンケート調査を行った。多職種協働糖尿病チームケアを促進する看護実践質問表25項目、外的基準としてソーシャルスキル尺度、批判的思考態度尺度を用いた。項目分析、因子分析を行い、信頼性にはCronbachの α 係数、基準関連妥当性にはスピアマンの順位相関係数を用いた。

結果：1,115名（48.6％）より回答が得られ有効回答は848名（76.0％）であった。女性819名（96.6％）、平均年齢38.5±9.5歳、平均糖尿病看護経験年数6.8±5.5年であった。因子分析によって25項目すべてが4因子構造で説明された。α 係数は25項目全体で0.95、外的基準との相関では、ソーシャルスキル尺度得点と $r=0.51$、批判的思考態度尺度得点と $r=0.52$ であった。

結論：構成概念妥当性、内的整合性および外的基準との併存的妥当性が確認された。以上より本質問表は信頼性および妥当性が確認された。