

Development and Validation of a Scale to Assess Dental Hygienists' Role as Knowledge Brokers in Korea

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ABSTRACT

Objectives: In this study, we aimed to evaluate the validity and reliability of the scale for dental hygienists' role as knowledge broker, a tool potentially useful to help to develop dental hygienists' role as a knowledge broker that meet the needs of the field and include it in dental hygiene curricula.

Method: This manuscript reports on a complex descriptive study involving both qualitative and quantitative sub-studies. It also includes a methodological study aiming to develop and verify the content validity and reliability of a scale for dental hygienists' role as a knowledge broker. The survey questionnaire was distributed to 240 dental hygienists who currently work in care institutions, including private hospital, dental hospital, or general hospital for at least three months, between June 8, 2015 and July 13, 2015.

Findings: To verify the reliability, validity, and unidimensionality of the 40 questionnaire items, exploratory factor analysis was performed with Varimax rotation. The exploratory factor analysis led to 17 items for three factors. In the confirmatory factor analysis, the path coefficients for all items were significant, at .588-.857. Based on the results of exploratory and confirmatory factor analyses and literature review of the role of knowledge brokers, its subfactors 1, 2, and 3 were named "explain and promote understanding", "deliver knowledge", and "link to resources", respectively. The goodness of fit of the structural equation model was examined using the following indices: $\chi^2=3.066$, GFI=.860, AGFI=.805, TLI=.882, CFI=.904, RMSEA=.094

Applications: We developed and validated a scale to assess the roles of dental hygienists in Korea as a knowledge broker. Reflecting the newly demanded roles of knowledge brokers in educational curricula will surely help dental hygienists to advance and improve themselves as health professionals.

Keywords: *Dental hygienist, Dental hygiene, Educational curricula, Knowledge Broker, Role*

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Introduction

Dental hygienists, along with dentists, play an essential role in preventing oral diseases and educating patients. Furthermore, they perform preventive treatments on dental patients, cooperate with dentists to promote efficient treatment, and instruct patients about oral management to prevent oral diseases^[1].

With increased economic standard and diverse medical demands in South Korea, the roles of dental hygienists are also expected to change. Professional dental hygienists are demanded to play a more diverse repertoire of roles, such as comprehensive dental hygiene treatment considering prophylactic treatment and aesthetic factors. As knowledge brokers, a recently emerged role, dental hygienists are required to equip the functions of questioning (plan on behalf of the patient), explaining (help patient to clearly understand healthcare information), and maintaining (hold onto the information delivered to the patient) ^[2,3].

Knowledge is information organized and analyzed to be used for problem-solving and decision-making^[4,5].

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A broker is a mediator at the center of information delivery who provides knowledge, resolves conflicts with collected information, and connect the two groups participating in knowledge exchange. In other words, a broker does not prefer a specific individual over the others and instead satisfies the needs of all. A knowledge broker is a compound term with the words of knowledge and broker. In other words, a knowledge broker is an individual or organization that partakes in the bidirectional exchange of knowledge between two parties, who delivers the knowledge or practice of one group to the another and mediates and connects the two parties, thereby creating a new opportunity for learning and innovation [6,7].

The roles of dental hygienists in Korea can be broadly categorized into cooperation with dental treatment, preventive treatment for oral diseases, oral health education, and hospital coordinator. Currently, dental hygienists in Korea are mostly involved in aiding dental care, but changes in the dental clinic environment and the resulting diversification, departmentalization, and specialization of clinical tasks call for an expansion of dental hygienists' scope of work as well. If a dentist's main work is dental care, a dental hygienist's main work is to provide preventive education to patients. Nevertheless, dental hygienists in Korea have been mostly involved in the works in dental care, as their fundamental role was not established properly. Since dental hygienists perform the roles of organizational managers or care aids at the same time they provide preventive treatment to people, oral health education and patient counseling, it is important to identify the skills, knowledge, and attitudes required in the clinical setting. This knowledge is critical to plan the education

of new dental hygienists and dental hygiene students accordingly and empower them as professionals meeting the demands of the field.

South Korea's 2002 National Competency Standards (NCS) recommend scientific and systematic identification and education of the standardized work capacities (knowledge, skills, attitude) required for successful work performance. Therefore, there is a need for a new model that is commensurate with today's context to maintain a qualitative balance between theory and actual practice about the role of knowledge broker in educational institutions and in the field of employment. In order to develop the true role of dental hygienists, as opposed to merely giving theory education focused on delivering dental medical knowledge, and to reflect the roles of knowledge broker as demanded in the current era, it would be necessary to understand whether relevant knowledge is used or shared as a "common language" between dental hygienists and dental hygiene students.

In this study, we aimed to evaluate the validity and reliability of the Scale for Dental Hygienists' Role as Knowledge Broker, a tool potentially useful to help to develop dental hygienists' role as a knowledge broker that meet the needs of the field and include it in dental hygiene curricula.

Method

Study Design: This manuscript reports on a complex descriptive study involving both qualitative and quantitative sub-studies as shown in Figure 1. It also includes a methodological study aiming to develop and verify the content validity and reliability of a scale for dental hygienists' role as a knowledge broker.

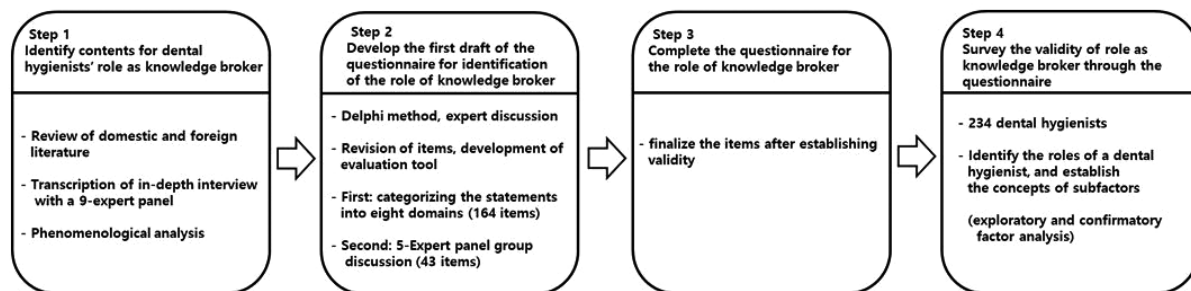


Figure 1: Study flowchart

Study Subjects: This study was approved by the Institutional Review Board at Hanyang University (IRB No: HYI-15-020-1). The survey questionnaire was distributed to 240 dental hygienists who currently

work in care institutions, including private hospital, dental hospital, or general hospital for at least three months, between June 8, 2015 and July 13, 2015. All participants consented to participate in the study. All

of the 240 questionnaires were retrieved, and after excluding three questionnaires completed by a male dental hygienist and three incomplete questionnaires, a total of 234 questionnaires were included in the final analysis. The sample size was computed according to [8] using G-power 3.1.7 for correlational analysis with a significance of 0.05, power of 80%, and medium effect size of 0.2. The calculated sample size after considering dropout and loss rates was 200, so the sample size used in this study was adequate.

Study Procedure

Development of questionnaire items for Dental Hygienists' Roles as Knowledge Mediators: After analyzing the tasks of dental hygienists and the definition and duties of a knowledge broker based on a review of national and international literature, we conducted an in-depth interview of three dental hygienists who have been working in a care institution for more than 10 years and six dental hygiene professors, from April 11, 2015 to May 17, 2015, using a semi-structured questionnaire asking the following questions: What is the role of knowledge broker to a dental hygienist? How does a dental hygienist perform the role of a knowledge broker? Why is the role of a knowledge broker important to a dental hygienist? When does a dental hygienist perform the role of a knowledge broker? Where does a dental hygienist perform the role of a knowledge broker? What obstacles hinder a dental hygienist from performing the role of a knowledge broker? With the participants' consent, the interview data were recorded and then transcribed. Based on [9] phenomenological methodology, 187 meaningful statements were identified and clustered with similar categories, resulting in 164 statements. Based on discussion and revision by five healthcare majors, including this author, 43 questionnaire items for "knowledge broker" were developed.

Validity verification of the knowledge broker and questionnaire structure: The content validity of the role model for the dental hygienists as a knowledge broker developed in this study was verified by nine experts. The cutoff for Content Validity Index (CVI) by experts is generally set at 70%, but considering the fact that "knowledge broker" may be a newly emerged concept, we set the cutoff at 55%. As a result, three items in the first draft were removed, resulting in a final tool with 40 items

Study Instruments: The final instrument included 40 items that were validated by experts. Both affirmative and negative statements were randomly arranged to eliminate careless uniform responses. The items were structured so as to be answered with 1-2-3-4-5, and negative statements were reverse-coded during analysis to match the direction of the questionnaire items. The reliability of the 40 items was identified to be high, Cronbach's $\alpha = .946$.

Data Analysis

Dental hygienists' general characteristics were analyzed to obtain descriptive statistics, including frequency and percentage, mean and standard deviation using SPSS 18.0 and AMOS 18.0. Dental hygienists' roles as a knowledge broker was examined with exploratory factor analysis and confirmatory factor analysis. The goodness of fit of the study model was analyzed with (Chi-square), TLI (Tucker-Lewis Index), CFI (Comparative Fit Index), and RMSEA (Root Mean Square Error of Approximation).

Results and Discussion

Participants' Demographic Characteristics: The mean age and mean career's length were 31.1 years and 4.28 years, respectively. 58.1% (n=136) of the participants were between 24-33 years old and 71.8% were single (n=168). With regard to the highest level of education, 72.2% had an associate degree (n=169), and 54.3% had a career of between 3-9 years (n=127). A total of 89.3% were under permanent employment (n=209). Most participants were single had an associated degree, and were in permanent positions. Further, 60.7% (n=142) worked in a dental clinic, 73.9% (n=173) worked in a treatment room, and 87.6% (n=205) were in charge of clinical work. About 54.3% (n=127) had taken a refresher course, while 79.5% (n=186) had never heard of the term knowledge broker. As shown here, most dental hygienists were in charge of clinical work in the treatment room in dental clinics.

Validity Analysis

Results of Exploratory Factor Analysis: To verify the reliability, validity, and unidimensionality of the 40 questionnaire items, exploratory factor analysis (principal component analysis) was performed with Varimax rotation. The cutoff for inappropriate items was set at .6 or below. The exploratory factor analysis led to 17 items for three factors

Results of Confirmatory Factor Analysis: In the confirmatory factor analysis, the path coefficients for all items were significant, at .588-.857. In general, a standardized factor loading between .50 and .95 is deemed good [10]. The t value shows the degree of agreement among various items that measure the same concept, and it must be greater than 1.96 [11]. All 17 items had a large t value, so the scale was considered unidimensional. An average variance extracted (AVE) of .50 or higher and a construct reliability of .70 or higher are considered to confirm the convergent validity. In the present study, the AVE ranged between .55 and .56 and the CR ranged between .83 and .89, confirming high convergent validity (Table 1 and Figure 2).

Based on the results of exploratory and confirmatory factor analyses and literature review of the role of

knowledge brokers, its subfactors 1, 2, and 3 were named “explain and promote understanding,” “deliver knowledge,” and “link to resources,” respectively. Our study model describes the complex mutual relationship among the sub-concepts. In the existing job model for dental hygienists, tasks such as: B3. establish project plan for local community oral health projects; B4. establish project plans for oral health projects by lifecycle; C1. enroll patients and prepare for care; C9. provide preventive dental care; and C33. launch local community oral health projects included similar concepts to the duties of a knowledge broker, but there is no specific job description for a “knowledge broker.” The duties of dental hygienists as a knowledge broker defined in this study are all under one dimension, which suggests that the scale we developed is appropriate as a measurement instrument for further studies.

Table 1: Results of Confirmatory Factor Analysis

N = 234

Factor		Variables	FL	t-value	CR	AVE
Factor 1 Explain and promote understanding	26	Repeatedly explain to help understanding.	.857	10.38	.89	.55
	14	Play a mediating role between dentists and employees and between patients and dentists.	.811	10.00		
	8	First understand the most pressing need of the patient.	.771	9.64		
	35	While explaining to the patient about what will happen before and after treatment, additionally explain and help patient understand when the patient asks questions.	.765	9.59		
	6	Explain to the patient about the treatment plan, process, and diagnosis.	.735	9.45		
	15	Try to create a comfortable, friendly, and satisfactory atmosphere for the patient.	.610	8.15		
	32	More senior dental hygienists should teach clinical work to younger dental hygienists.	.609			
Factor 2 Deliver knowledge	12	Develop education programs.	.803	10.20	.88	.56
	11	Create an online posting containing verified knowledge and share it via social media.	.801	10.19		
	24	Give 1:1 online consultation.	.792	10.18		
	10	Regularly manage the bulletin board and change the contents of the video shown in the waiting room.	.748	9.80		
	19	Explain using a computer.	.648	10.22		
	25	Regularly check recalls to deliver customized knowledge.	.646			
Factor 3 Link to resources	37	Fulfill the role of a knowledge broker regardless of the place of work, including dental hospitals and clinics, health examination centers, public health centers, and culture centers.	.837	9.07	.83	.56
	28	Explain and promote the dental medical system to community residents to help them receive the benefits.	.812	8.97		
	33	Provide knowledge sources to help decision-making.	.714	8.29		
	40	Gladly participate in small or large medical volunteering activities in Korea and abroad.	.588			

Goodness of Fit: The goodness of fit of the structural equation model was examined using the following indices: =3.066, GFI=.860, AGFI= .805, TLI=.882, CFI=.904, RMSEA=.094 (Table 2).

Table 2: Goodness of fit

N = 234

Category	Recommended standard	Goodness of fit	Category	Recommended standard	Goodness of fit
/df	$3 \geq /df \geq 1$	3.066	TLI	$TLI \geq .9$.882
CFI	$CFI \geq .9$.904	GFI	$GFI \geq .9$.860
AGFI	$AGFI \geq .8$.805	RMSEA	$RMSEA \leq .08$.094

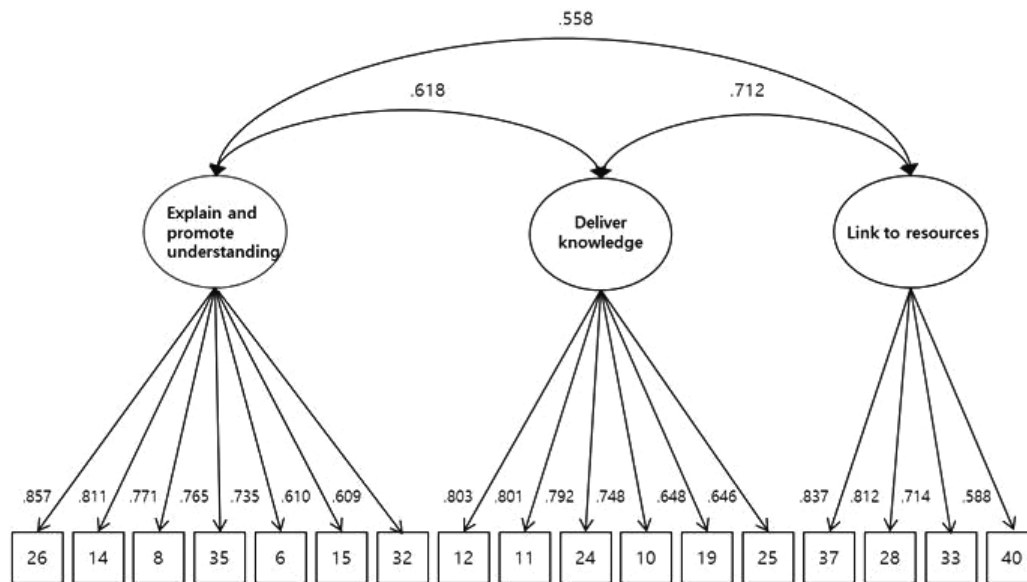


Figure 2: A Confirmatory Factor Analysis Model

Table 3 shows the results of the Pearson bivariate correlation analysis that was performed to analyze the correlations among each factor of the knowledge broker scale. There was a positive correlation between “explain and promote understanding” and “deliver knowledge” ($r=.54, q=.000$) and between “explain and promote understanding” and “link to resources” ($r=.58, q=.000$). Discriminant validity was tested with correlation coefficients and AVE values, where the correlation coefficient between each factor must be smaller than the AVE value. The correlation coefficients for the three factors ranged from $r=.54-.59$, and they were smaller than the square root of AVE (.74-.75), thereby establishing discriminant validity.

Table 3: Correlations Among Factors and Discriminant Validity

N = 234

	Explain and promote understanding	Delivery of knowledge	Link to resources
Explain and promote understanding	.74		
Delivery of knowledge	.54**	.75	
Link to resources	.58**	.59**	.75
Cronbach’s α	.89	.88	.82

* $p < .05$ ** $p < .01$ *** $p < .001$ (The shaded section: discriminant validity, The non-shaded section: correlation)

A knowledge broker mediates two separate sectors by learning and acquiring knowledge or information produced in one context or other types of resources and introducing them to the other sector in which they are yet unknown^[12,13]. In this study, we aimed to identify the roles of a knowledge broker, which would help us to establish the scope of oral hygiene services given by dental hygienists, and to develop relevant capacities that meet the needs of the healthcare field so as to include them in the dental hygiene curriculum. Currently, the national dental hygienist examination comprises a theoretical aspect focused on aiding in various types of care and a practical aspect that evaluates students' manipulation of particular devices. Due to the lack of education in regard to students' potential role as a knowledge broker, which is often demanded in the clinical setting, it takes a long time for newly licensed dental hygienists to adjust to their clinical work.

Identifying the duties of dental hygienists in the clinical setting and reflecting them in the educational curriculum to equip the prospective dental hygienists with the required skills is crucial if we want to develop education in dental hygiene. The ability to provide a comprehensive dental hygiene service, particularly by explaining and promoting understanding, delivering knowledge, and linking to resources, is a novel intellectual capacity and skill. "Explaining and promoting understanding" are important roles of knowledge brokers that could be separated from the existing health education. There is a need for professionals who mediate knowledge to assist dental hygiene consumers in making the correct choices and fulfill their rights and duties. The scale developed in this study can comprehensively assess the psychosocial factors and other factors involved in the development of dental hygienists' competence. We anticipate the scale can be applied in the clinical setting as well. However, given the dynamic nature of professional duties such as those discussed in this manuscript, replication studies should be conducted continually so as to keep abreast with the changes of jobs in this rapidly evolving healthcare environment

Conclusion

We developed and validated a scale to assess the roles of dental hygienists in Korea as a knowledge broker. The scope of dental hygienists' work, which had been largely focused on assisting in dental care, has

been diversified, subdivided, and specialized according to the needs of service consumers. Reflecting the newly demanded roles of knowledge brokers in educational curricula will surely help dental hygienists to advance and improve themselves as health professionals.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: Nil

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