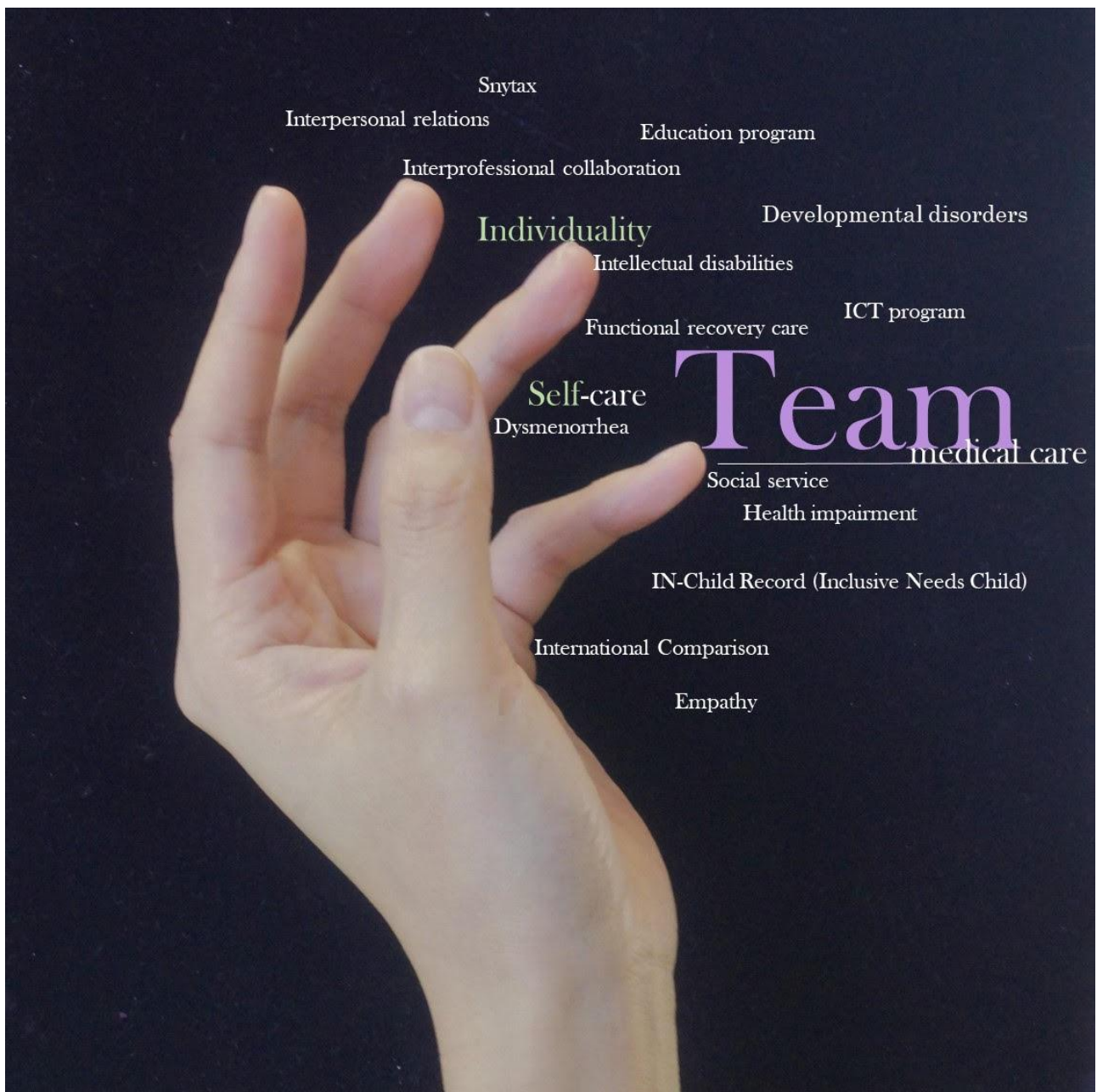


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ORIGINAL ARTICLE

Development of a Draft Clinical Interpersonal Reactivity Index to Evaluate Empathy in Nurses

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ABSTRACT

Objective: The purpose of this study was to develop a draft Clinical Interpersonal Reactivity Index to evaluate empathy, sympathy and “perspective taking” in nurses. Creating a Clinical Interpersonal Reactivity Index is expected to contribute to improving the mental health of nurses. Participants were five nurses who were able to talk about empathy and who were recommended by a facility administrator. Research data were collected in semi-structured interviews. The rigor of the items was verified by comparing the items with two existing theories, a nursing theory by Travelbee and a psychological theory by Rogers.

Results: All participants were female and aged between 34 and 64 years (average 47.4 years). As a result of the interviews, 27 items were developed. The dependability of all items was confirmed since they conformed to Travelbee’s and Rogers’ theories, and the credibility was confirmed by discussion between eight nursing researchers, including the authors. Twenty-seven items were developed to evaluate the empathy, sympathy and “perspective taking” required for nurses providing patient care and were considered appropriate for the draft Clinical Interpersonal Reactivity Index. Statistical verification of the items is necessary for use of the Clinical Interpersonal Reactivity Index in the future.

< Keywords >

empathy, interpersonal relations, nurse-patient relations, mental health, nurses

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I. Introduction

Strong empathy among Japanese people has been regarded as an important matter, despite the concept being abstract and difficult to verbalize. Empathy in nursing practice is considered the most fundamental ability in constructing relationships between nurses and patients and is important for carrying out nursing care. However, empathizing with a patient's complicated emotions, such as pain and suffering that nurses may not have personally experienced, becomes emotional labor and leads to stress in nurses (Hochschild, 1983; Katayama, 2010; Katayama, Ogasawara & Tsuji, et al., 2005).

Travelbee (1963), who explored the interpersonal aspects of nursing, said that empathy was the process of being able to understand others, and sympathy was the phase in which nurses think about wanting to care for patients. Empathy and sympathy are necessary to build a relationship between a patient and nurse, and are often thought to be confusing (Travelbee, 1963). Rogers (1957), who showed the importance of empathy from a clinical psychology perspective, stated the following regarding effective counseling: *"To sense the client's private world as if it were your own, but without ever losing the "as if" quality-this is empathy, and this seems essential to therapy."* Thus, a nurse's empathy for patients has been shown to be indispensable in the practice of mental care. The social psychologist, Davis (1996), stated that it is important for interpersonal donors to have the ability of "perspective taking," which is one of the cognitive aspects of empathy. "Perspective taking" is having the attitude of attempting to understand the feelings of others by imagining their viewpoint (Davis, 1983; 1996).

Evaluation of empathy in nursing studies in Japan has been conducted by using the Emotional Empathy Scale (Mehrabian & Epstein, 1972; Kato & Takagi, 1980), the Revised Empathic Experience Scale (Kakuta, 1994), and the Multi-dimensional Empathy Scale (Davis, 1983; Mochizuki, 2007; Tobari, 2003). These scales consist of items to evaluate empathy and include items such as agreement, involvement, and sympathy for a person, and items that evaluate "perspective taking" are rarely included. In addition, the Japanese version of the Interpersonal Reactivity Index (Davis, 1983; Himichi, Osanai & Goto, et al., 2017) was recently re-translated into Japanese for statistical verification in order to prove its validity. "Perspective taking" as included in the Japanese version of the Interpersonal Reactivity Index contains seven items that indicate general interpersonal relationships (Himichi, Osanai & Goto, et al., 2017). Therefore, the contents of these items show the interpersonal relationship between a nurse and a patient; however, it is necessary to develop a Clinical Interpersonal Reactivity Index specifically to evaluate empathy in nurses. Therefore, the purpose of this study was to develop a Clinical Interpersonal Reactivity Index to evaluate empathy in nurses, which is expected to contribute not only to improving the quality of mental care provided to patients, but also to improving the mental health of nurses.

II. Methods

1. Study setting and participants

This study was a temporary, point qualitative inductive study conducted from July 2017 to March 2018. Snowball sampling was used to select two facilities caring for hospitalized patients at the end-of-life or in a psychiatric ward. Such facilities are considered to be settings in which nurses must exercise empathy towards patients (Inagaki, Furuzawa & Murase, 2016; Murakami, Higa & Tanaka, et al., 2016; Noto, Mikami & Komatsu, 2002; Tanaka, Yoshino & Hasegawa, 2015). The first author spoke directly with the administrator of each facility to describe the study purpose and to request participation. The participants were five nurses who were recommended by the administrators as being able to talk about the experience of empathy in nursing care. The duration of nursing experience was not part of the inclusion criteria.

2. Interviews

The researchers gave the participants an explanation of the research, an explanation of “empathy required for nurses,” and then conducted semi-structured interviews that lasted about 20 minutes. The interviews were conducted following an interview guide that consisted of the following three questions: “Do you think that agreeing with a patient is different than having empathy or sympathy for a patient?”, “Do you have experiences in which it is difficult to empathize with patients?” and “What do you think about a nurse’s empathy for patients?” Interviews were held at either one of the researchers’ institutions or the participant’s facility. Interview contents were recorded and then transcribed verbatim into text data.

3. Analysis

Using the transcribed text data from interviews with the five nurses, the meaningful parts were extracted as items for evaluating the empathy required for nurses and then summarized as codes. The codes were then abstracted and made into items. In addition, the dependability was confirmed by checking for consistency with Travelbee’s four phases and Rogers’ four conditions. The dependability and credibility of the items were confirmed in two separate meetings between eight nursing researchers, including the authors.

Travelbee (1971) stated that “*a human-to-human relationship is established after a nurse and the recipient of her care have progressed through four preceding interlocking phases. These phases are: (1) the original encounter, (2) emerging identities, (4) empathy and (5) sympathy*” (Travelbee, 1971). Travelbee (1971) said that “*all of these phases culminate in rapport and the establishment of the human-to-human relationship.*”

Rogers (1957) listed six conditions as a process necessary for effective psychotherapy. These conditions are also common to the process of establishing interpersonal relationships between patients and nurses that include empathy. Of the six the conditions,

condition 2 (“*The first, whom we shall term the client, is in a state of incongruence, being vulnerable or anxious*”) and condition 6 (“*The communication to the client of the therapist’s empathic understanding and unconditional positive regard is to a minimal degree achieved*”) are conditions that the client should evaluate (Rogers, 1957). These two conditions were not thought to match the items extracted from the interviews with the participating nurses and were excluded from the analysis. Therefore, this study used the remaining four conditions, which were considered to be compatible with items extracted from the interview contents. The four conditions were as follows: condition 1, “*Two persons are in psychological contact*,” condition 3, “*The second person, whom we shall term the therapist, is congruent or integrated in the relationship*,” condition 4, “*The therapist experiences unconditional positive regard for client*,” and condition 5, “*The therapist experiences an empathic understanding of the client’s internal frame of reference and endeavors to communicate this experience to the client*” (Rogers, 1957). These conditions are also considered necessary for nurses’ empathy.

4. Ethical considerations

This study was approved by the ethics committee of the authors’ institution (No. 17-080). The lead author gave a verbal and written explanation of the ethical considerations to all participants and obtained written, informed consent to participate from all participants.

III. Results

Five participants from two facilities cooperated in this study. The age of the participants ranged from 34 to 64 years (average 47.4 years) (Table 1).

Table 1. Participant characteristics

ID	Age (years)	Nursing experience (years)
A	48	18
B	51	31
C	40	18
D	34	13
E	64	43

All participants were female.

Audio data from the interviews totaled 85 minutes and 15 seconds. As a result of the analysis, 93 codes indicating empathy required for nurses were obtained and 27 items were extracted (Table 2-1, Table 2-2, Table 2-3, Table 2-4 and Table 2-5). Tables 2-1 to 2-5 show both the items and representative abstracted codes obtained from interviews with the five nurses.

Table 2-1. Clinical Interpersonal Reactivity Index items and abstracted codes (Items 1-6)

	Item	Abstracted code (Participant's ID)	Code number
1	<u>The patients and I search for solutions to their problems together.</u>	I do not tell a patient who is suffering that "Your SPO ₂ is good" or "I do not see like you suffering." I think that it is important to tell patients that "I know you are suffering now" or ask them "Why are you suffering?" (C)	9
2	<u>Although I cannot put myself in a patient's shoes, I try to imagine and understand their feelings as best I can.</u>	I cannot become that patient. I do not understand the patient's suicidal ideation, but I'd like to understand the patient's suffering. I want to understand the patient's feelings. (B)	7
3	† <u>I feel irritated when patients use the nurse call repeatedly while I am busy.</u>	I want to listen to the patient sufficiently, but I cannot secure time to listen. I cannot go to the patient's room because I can imagine what the patient wants to talk about. Sometimes I have negative feelings like, "I have been called again." (C)	6
4	<u>I adjust my schedule and prepare myself emotionally so that I can listen to a patient's story.</u>	I can listen to the patient's story when I have time, when I am interested in that patient's story and when I want to listen to the patient's story. Even if the patient talks about the same story forever, I can listen to them. (C)	5
5	<u>I want to actively learn about my patients.</u>	If nurses are interested in the patient, they will want to listen to various stories. When I want to listen to the patient's story, I will go to the patient's room for a while. Therefore, I think that it is important that nurses have interest in the patient's story and want to know about the patients. (C)	5
6	<u>When interacting with patients, I try to imagine their feelings and tell them what I think.</u>	For example, I may be sued because a patient says their hand hurts, but it is somatic symptom disorder without any injuries on the surface of the body. At that time, I will tell them that "I understand, you are suffering because you feel the pain will continue forever."(A)	5

† : reversal item, underline: item

Table 2-2. Clinical Interpersonal Reactivity Index items and abstracted codes (Items 7-12)

Item	Abstracted code (Participant's ID)	Code number
7	<p><u>When I cannot understand a patient's feelings, I consider that the reason for this may be their disease and symptoms.</u></p> <p>I like to eat, so I cannot understand the feelings of patients with feeding and eating disorders. However, I understand the patient's symptom. The patient thinks he or she doesn't want to gain weight and thinks only about meals. I understand these patient's symptoms and I try to provide nursing care to help. (B)</p>	5
8	<p><u>I try to create an environment where patients can relax and talk.</u></p> <p>First of all, I think it is important to communicate with the patient himself. That is why I try to create a situation where patients can talk easily. (A)</p>	4
9	<p><u>I reflect on my attitude towards patients and try to improve it if necessary.</u></p> <p>I was tired from the involvement with a patient and had other nurses perform her care. Later, I got a written letter from her. The letter said, "I was saved by your very kind response." Then, I thought that there is a my way to be involved with her without suffering. (C)</p>	4
10	<p><u>When I have no time, I tell the patient in a straightforward manner, "I do not have time to talk to you now."</u></p> <p>If I say that "I do not have time now" frankly, the patient understands it. I think that nurses should frankly tell the patient that they do not have the time. (C)</p>	4
11	<p><u>I try to accept the experiences that the patient tells me about.</u></p> <p>I think that empathy is accepting what the patient is saying. Even though the patient says something is "painful", I cannot fully understand their suffering by any means. I do not fully understand, but I think the patient is suffering. (C)</p>	4
12	<p><u>To understand the patient, I think it is important to grasp their experiences, behavior, expressions, and life rhythm as a whole.</u></p> <p>I think that it is important to use a holistic outlook rather than just a part of the patient to understand them. The patient has their own world that we do not know, and even young people have various thoughts. I imagine the patient's life and talk to them so I can understand why the patient feels that way. (C)</p>	4

† : reversal item, underline: item

Table 2-3. Clinical Interpersonal Reactivity Index items and abstracted codes (Items 13-18)

Item	Abstracted code (Participant's ID)	Code number
13	<p><u>I make an effort to actively talk to patients.</u></p> <p>When I greet a patient, I am going to make casual conversation everyday and create a situation where people can talk to me naturally. For that reason, I try to speak to all patients even a little bit. (A)</p>	3
14	<p><u>I listen to patients unconditionally, without thinking something regardless of whether I can help them.</u></p> <p>When I hear about a patient, I think "Because it's primary, it is primary." Anyway, I thought that I have to listen to the patient's story every day. But, sometimes I am not interested in patients at that time. (C)</p>	3
15	<p><u>Even when a patient refuses my involvement, I want to understand their feelings.</u></p> <p>When the patient refuses me, if the patient calms down due to my absence, I will leave the patient's room. However, I think that it is necessary to obtain patient information from other nurses and to confirm the situation. I think that it is necessary to know the patient's feelings because the patient refused me. (C)</p>	3
16	<p><u>When I provide guidance to a patient, I try to show them that I understand their feelings.</u></p> <p>When I am guiding a patient, I will tell the patient what he or she needs. And I think about the patient and try to incorporate the patient's opinion. I understand the feelings of patients and giving guidance to the patient. (B)</p>	3
17	<p><u>I wait for patients to talk naturally, and I often visit them in their room.</u></p> <p>I never ask the patient about every detail of something that he or she does not want to say. I wait for the patient to speak naturally and go to see them in person many times. (C)</p>	2
18	<p><u>I think it is necessary to let another nurse handle my patient when I feel negatively toward the patient and it is difficult for me to talk with them.</u></p> <p>I want to escape from patients that are difficult to be involved with. I think that rather than escaping from patients, a good way is to stay a little bit far away at that time. (C)</p>	2

† : reversal item, underline: item

Table 2-4. Clinical Interpersonal Reactivity Index items and abstracted codes (Items 19-24)

	Item	Abstracted code (Participant's ID)	Code number
19	<u>I can talk to my boss about patient relationships.</u>	When I feel troubled about a relationship with a patient, I consult with senior nurses. I say that "I have a problem with a patient like this, I am in trouble." (D)	2
20	<u>I want all patients to recover, even those who insulted me or were violent toward me.</u>	A patient hurt my arm previously. That time was when he was sick. He recovered, but he did not remember hurting me. I was glad that he recovered and was discharged from the hospital. (A)	2
21	<u>Although I may not know the exact amount of suffering that the patient is experiencing, I tell them that I understand their suffering.</u>	I think that the nurse's empathy is to understand the patient's feeling now. The nurse tells a patient who has pain from respiratory discomfort that, "I understand, it is painful." I do not understand all the suffering of the patient, but I think nurses should have the attitude that they understand that the patient is in pain. (C)	2
22	† <u>I think that when a patient consults me, they are asking me for the answer to a problem.</u>	When the patient wants to talk, the patient puts his or her feelings into words and I think that I only need to say "You think so." Then I think that the patient will feel comforted. (B)	2
23	† <u>I often doubt and cannot understand patients' stories.</u>	I think it is not good to doubt the patient. Even if the patient cannot understand, I think it is important to not involve doubt. (B)	2
24	<u>I think that there are reasons for abuse, violence, and refusals from patients.</u>	There was a patient who used violence towards nurses when their condition was bad. After the symptoms recovered, I asked if the patient remembered that time but he did not remember at all. I think that using violence towards nurses is a painful experience that contradicts their intentions. (A)	2

† : reversal item, underline: item

Table 2-5. Clinical Interpersonal Reactivity Index items and abstracted codes (Items 25-27)

Item	Abstracted code (Participant's ID)	Code number
25	<p><u>I talk to patients in a kind tone and listen to their stories.</u></p> <p>First, I will prepare a pleasant environment for patients. And I talk without using an angry or cold tone of voice as much as possible for my patient. I do not give my opinion, I take good care to be a listener. (B)</p>	1
26	<p>† <u>I think it is important to give advice to patients.</u></p> <p>I had to listen to a story from a patient with schizophrenia who said "I am worried about my future" and "I want you to hear my story". I did not give advice, but I said something like that "This is it" about her future. Then she shouted "Don't sugarcoat it." At that time, I thought that it would be okay to just listen to the patient's story. (B)</p>	1
27	<p>† <u>I cannot understand patients who make unreasonable demands or exhibit troublesome behavior.</u></p> <p>When I was busy, I was told by the patient that "I want you to be nearby because I am lonely". I felt it was difficult to show empathy when the patient's request did not change even when I explained that I was busy. The patient tried to manipulate nurses and had dissociative symptoms that are hard to understand and are difficult to empathize with. (B)</p>	1

† : reversal item, underline: item

The 27 extracted items conformed to Travelbee's phases and Rogers' conditions as described in Tables 3-1 and 3-2. Square brackets [] indicate an item.

Items 8, 13, 17 and 25 matched phase 1 and condition 1. These included [Item 8: I try to create an environment where patients can relax and talk].

Items 3, 4, 9, 10, 18 and 19 matched phase 2 and condition 3. These included [Item 3: I feel irritated when patients use the nurse call repeatedly while I am busy] (reversal item).

Items 2, 5, 14, 15 and 20 matched phase 3 and condition 4. These included [Item 2: Although I cannot put myself in a patient's shoes, I try to imagine and understand their feelings as best I can].

Items 1, 6, 7, 11, 12, 16, 21-24, 26 and 27 matched phase 4 and condition 5. These included [Item 1: The patients and I search for solutions to their problems together]. Items 22, 23, 26 and 27 were reversal items. The extracted items and codes, and the compatibility of the phases and conditions were ensured by rigorous discussion between eight nursing researchers, including the authors.

Table 3-1. Matching the Clinical Interpersonal Reactivity Index items with Travelbee's and Rogers' existing theories.

Travelbee's phases	Rogers' conditions	Item	Number of items
1	1	8 I try to create an environment where patients can relax and talk.	4
		13 I make an effort to actively talk to patients.	
		17 I wait for patients to talk naturally, and I often visit them in their room.	
		25 I talk to patients in a kind tone and listen to their stories.	
2	3	3 † I feel irritated when patients use the nurse call repeatedly while I am busy.	6
		4 I adjust my schedule and prepare myself emotionally so that I can listen to a patient's story.	
		9 I reflect on my attitude towards patients and try to improve it if necessary.	
		10 When I have no time, I tell the patient in a straightforward manner, "I do not have time to talk to you now."	
		18 I think it is necessary to let another nurse handle my patient when I feel negatively toward the patient and it is difficult for me to talk with them.	
19 I can talk to my boss about patient relationships.			
3	4	2 Although I cannot put myself in a patient's shoes, I try to imagine and understand their feelings as best I can.	5
		5 I want to actively learn about my patients.	
		14 I listen to patients unconditionally, without thinking something regardless of whether I can help them.	
		15 Even when a patient refuses my involvement, I want to understand their feelings.	
		20 I want all patients to recover, even those who insulted me or were violent toward me.	

† : reversal item

Travelbee's phases: Phase 1 is the original encounter, phase 2 is emerging identities and phase 3 is empathy. **Rogers' conditions:** Condition 1, "two persons are in psychological contact;" condition 3, "the second person, whom we shall term the therapist, is congruent or integrated in the relationship;" and condition 4, "the therapist experiences unconditional positive regard for the client."

Table 3-2. Matching the Clinical Interpersonal Reactivity Index items with Travelbee's and Rogers' existing theories.

Travelbee's phases	Rogers' conditions	Item	Number of items
		1 The patients and I search for solutions to their problems together.	
		6 When interacting with patients, I try to imagine their feelings and tell them what I think.	
		7 When I cannot understand a patient's feelings, I consider that the reason for this may be their disease and symptoms.	
		11 I try to accept the experiences that the patient tells me about.	
		12 To understand the patient, I think it is important to grasp their experiences, behavior, expressions, and life rhythm as a whole.	
		16 When I provide guidance to a patient, I try to show them that I understand their feelings.	
4	5	21 Although I may not know the exact amount of suffering that the patient is experiencing, I tell them that I understand their suffering.	12
		22 † I think that when a patient consults me, they are asking me for the answer to a problem.	
		23 † I often doubt and cannot understand patients' stories.	
		24 I think that there are reasons for abuse, violence, and refusals from patients.	
		26 † I think it is important to give advice to patients.	
		27 † I cannot understand patients who make unreasonable demands or exhibit troublesome behavior.	

† : reversal item

Travelbee's phases: Phase 4 is sympathy. **Rogers' conditions:** Condition 5, "the therapist experiences an empathic understanding of the client's internal frame of reference and endeavors to communicate this experience to the client."

IV. Discussion

1. Strictness of the items and availability

The items were extracted from the data obtained in interviews with the five participating nurses. The items were checked to see whether they conformed to the theories of Travelbee and Rogers, and all items fit. Through rigorous discussion between eight nursing researchers, including the authors, the rigor of the items was thought to be

confirmed. The nursing researchers considered Travelbee's phases and Rogers' conditions as follows. Phase 1 and condition 1 indicate that it is necessary for the nurse to prepare to listen to the patient's story. Therefore, items that create situations that make it easy for the nurse and patient to communicate, such as improving the patient's environment and using a kind tone of voice, were included (items 8 and 25). Items related to nurses' efforts and attitudes towards listening to patients were also included (Items 13 and 17). Phase 2 is described as follows (Travelbee, 1963), "*The phase of emerging identities is characterized by the ability to appreciate the uniqueness of another person, as well as the ability to establish a bond with the other individual.*" In order to accept a patient's emerging identity, it is necessary for the nurse's own identity to be integrated. Condition 3 is described as follows (Rogers, 1957). "*The third condition is that the therapist should be within the confines of this relationship, a congruent, genuine, integrated person.*" The nursing researchers thought phase 2 would be achieved by condition 3, so the same items were included. In addition, items related to how nurses' review and adjust their actions (items 4, 9, 18), items related to how nurses' act when adjustment is not possible (item 3), and items related to genuineness (items 10, 19) were included. Phases 3 and condition 4 indicate that patients need nurses to show interest in their wellbeing (Rogers, 1957; Travelbee, 1963). Therefore, even when a nurse is rejected by a patient or when a patient is violent towards a nurse, items related to nurses showing a positive interest in patients were included (Items 2, 5, 15, 20). In addition, one item indicating nurses' unconditional interest in patients was included (item 14). Phases 4 and 5 indicate that nurses understand their patients and help to find solutions for their care and comfort (Rogers, 1957; Travelbee, 1963). Therefore, items related to nurses trying to communicate what they understand about a patient (items 6, 16, 21), items showing ways of understanding (items 7, 11, 12, 21, 24), and one item related to helping find solutions to patients' problems (item 1) were included. In addition, one item indicating a lack of understanding on the part of the patient (item 27), items related to giving advice to the patient (items 22, 26), and one item related to misunderstanding patients (item 23) were included as reversal items.

Davis (1996) stated that "perspective taking," a cognitive aspect of empathy, is necessary for aid actions and affects patients. Of the 27 extracted items, five items (items 2, 6, 7, 15 and 21) were thought to be items that nurses are not able to experience in the same way as the patient, but nurses can show that they can imagine and understand the patient's feelings. These items are considered to be consistent with the concept of "perspective taking." Therefore, it is thought that the Clinical Interpersonal Reactivity Index is composed not only of items that can evaluate the emotional aspects of empathy, but also items that can be evaluated from "perspective taking," which is a cognitive aspect.

2. Empathy and Sympathy

Travelbee's (1963) phase 3, "empathy," is a process wherein an individual is able to comprehend the psychological state of another. Phase 4, "sympathy," on the other hand, implies a desire to aid the other individual in order to relieve his distress (Travelbee, 1963). These two concepts are easily confused. Travelbee (1963) indicated that a precondition of sympathy is that a nurse not over-identify or be emotionally involved with the patient. Rogers (1957), on the other hand, stated that condition 5, empathy, "*is that the therapist is experiencing an accurate, empathic understanding of the client's awareness of his own experience. To sense the client's private world as if it were your own, but without ever losing the "as if" quality.*" The "as if" quality is the same as over-identification with a patient. Therefore, it can be said that Travelbee's (1963) concept of "sympathy" and Rogers' theory of "empathy" may have the same meaning. Because of this, it is possible that the interpersonal response to the patient that is necessary for nurses is the nurse not over-identifying with the patient. Items 6, 7, 11 and 21 included in phase 4 and condition 5 were extracted from codes related to trying to understand the patient's feelings so that the patient and the nurse themselves are not identical. Therefore, it is thought that the items evaluating empathy or sympathy required for nurses as indicated by Travelbee and Rogers are included in the 27 items of the Clinical Interpersonal Reactivity Index developed in this study.

V. Conclusion

Based on interviews conducted with five participating nurses, 27 items were extracted to include in the Clinical Interpersonal Reactivity Index. These 27 items were considered to be appropriate to evaluate the empathy required for nurses. However, statistical verification of the items in the draft Clinical Interpersonal Reactivity Index developed in the present study is necessary in the future.

VI. Limitations

The present study had only five participants from two facilities. The interview duration was short at about 20 minutes per person. In addition, since we assessed the rigor of the items based only on the experiences of researchers, further verification is necessary. Therefore, it is necessary to evaluate the reliability and validity of the 27-item Clinical Interpersonal Reactivity Index developed in the present study by conducting statistical verification in the future.

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