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Psychological Insulin Resistance and Low Self-efficacy as Barriers to Diabetes Self-care Management in Patients with Type 2 Diabetes

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Purpose: This study aimed to identify the associations among psychological insulin resistance, diabetes self-efficacy, and diabetes self-care management in Korean patients with type 2 diabetes requiring insulin therapy. **Methods:** This study was a part of a parent study, for which data were collected from December 2015 to March 2016. Participants were 192 patients with type 2 diabetes who were recommended insulin therapy but were either not taking insulin or had been taking it for less than one year. Data were analyzed using descriptive statistics and Pearson's correlation coefficient. To identify the predictors of diabetes self-care management, sociodemographic and disease-related characteristics, psychological insulin resistance, and diabetes self-efficacy were entered into the hierarchical multiple regression model. **Results:** The mean age of participants was approximately 63 years, and 56.3% were men. A significant negative correlation was found between diabetes self-care management and psychological insulin resistance (r=-.19, p=.010), whereas self-care management and diabetes self-efficacy were positively correlated (r=.56, p<.001). In the hierarchical multiple regression model, psychological insulin resistance and diabetes self-efficacy were both strong predictors of diabetes self-care management after controlling for covariates such as education and economic status. **Conclusion:** The levels of both psychological resistance and diabetes self-efficacy should be considered when educating and counseling patients in order to promote diabetes self-care management. Further research is needed on what type of intervention will improve self-care management in terms of reducing psychological insulin resistance and improving self-efficacy.

Key Words: Insulin resistance; Diabetes mellitus; Self-management; Self-efficacy

INTRODUCTION

Type 2 diabetes is a chronic condition that requires individuals to maintain good self-care. By 2040, patients with type 2 diabetes are expected to account for over 10% of patients with chronic diseases worldwide [1]. The prevalence of type 2 diabetes among patients aged over 30 years in South Korea has increased rapidly over the past decade, from 5.6% in 2006 to 9.1% in 2013 [2].

The ultimate goal of treatment for type 2 diabetes is to prevent chronic complications and aid in the maintenance of a healthy life through effective glycemic control [3], but it relies heavily on self-care behavior [4]. Self-care management involves following the recommendations of health professionals to maintain health [5]. Research on Diabetes Self-Care Management (DSCM) has focused on how to improve self-care management among these patients. According to recent recommendations, educational programs for diabetes patients need to be tailored to their preferences in order to improve self-efficacy of self-care [6]. Self-efficacy is defined as the belief that successfully changing a specific behavior will bring about specific outcomes. This concept has been considered a major aspect of personal behavioral change [7] and a consistently strong and positive factor influencing self-care management [8].

Even when patients maintain their self-care manage-

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ment, the necessity of insulin therapy increases with the progression of diabetes; when initiated at the appropriate time, insulin therapy can improve patients' treatment satisfaction and quality of life. This is because the risk of diabetes complications declines when good blood glucose control is achieved [9]. However, despite its benefits, insulin therapy is often rejected or delayed by patients [9,10]. This is associated with a psychological state known as Psychological Insulin Resistance (PIR) [11], characterized by negative perceptions of insulin therapy, low confidence in insulin self-injection, and lack of support from surrounding people [11,12]. PIR is influenced by factors such as beliefs and attitudes, knowledge and intention, self-efficacy, fear, and satisfaction regarding diabetes treatment [13]. According to the concept analysis by Song [12], the attribute of PIR in Korean patients was different from that of inpatients from other cultural backgrounds. In Korean patients, mixed feelings (sorry and unfair situation, such as an annoyance that there is not enough energy to teach the housework) toward supporters such as family and friends were emphasized more than physical difficulties such as hypoglycemia [12]. In a study by Fu et al. [14], family engagement was also an important attribute of PIR in Chinese patients, but the authors explained that family support was inadequate among people with low levels of education. Song [12] and Fu et al. [14] emphasized the need to develop an assessment tool that can reflect cultural background. Recently, PIR has been actively researched in relation to DSCM, alongside self-efficacy. According to the study by Funnell et al. [15], when health professionals provide DSCM education programs and help diminish PIR, they make the transition to insulin therapy easier and help achieve more effective glycemic control.

Health behaviors are affected by various perceived barriers [7,14]. When people make judgments about a given health behavior, they consider not only the seriousness of the disease but also the barriers and benefits related to that behavior. The likelihood of performing the behavior is high when the barriers to that health behavior are low, and benefits are high [16]. Barriers are likely to affect individuals' ability to initiate and maintain health-related lifestyle changes. The variety of barriers to behavior are well-known predictors of health behaviors such as diet and exercise [7,12,16]. To maintain optimal glycemic control in diabetes, adapting and maintaining health behaviors related to self-care management is essential. At a certain point when insulin therapy becomes necessary, barriers to its adoption can affect other health behaviors associated with DSCM [12].

PIR consists of cognitive, psychological, and supportive aspects [12], and is not the mere rejection of insulin. It may, therefore, be considered a perceived barrier to DSCM. In other words, a person with diabetes may be better engaged in DSCM when PIR is low and Diabetes Self-Efficacy (DSE) is high. However, there appears to be little research investigating the relationship between PIR and DSCM. This study was conducted to identify the associations among PIR, DSE, and DSCM and to provide basic data on how to promote DSCM by investigating the levels of PIR, DSE, and DSCM in Korean patients with type 2 diabetes requiring insulin therapy.

METHODS

1. Study Design

The purpose of the parent study was to develop the scale for Korean psychological insulin resistance and its use in study for diabetes self-care management study in patients with type 2 diabetes. This study was a part of the parent study and a cross-sectional design was used to examine the associations among PIR, DSE, and DSCM in patients with type 2 diabetes.

2. Setting and Samples

The data for the current study were obtained from the parent study, which was a pilot study involving a survey to identify factors related to PIR. In the parent study, data were collected from the outpatient department of endocrinology at Chungnam National University Hospital in Daejeon City and the Public Health Service Center located in Sejong City from December 2015 to March 2016. The number of participants was calculated using the G*Power program with a significance level of α at .05, power (1-β) at .80, and an effect size of 0.67, as in a similar study [17]. Thus, at least 123 participants were required. We screened 209 individuals with type 2 diabetes. Among them, 12 were ineligible (A1C level of less than 7.0%) and five refused to participate. A total of 192 participants provided informed consent and responded to the survey. The inclusion criteria were as follows. Individuals with type 2 diabetes who (1) were > 18 years of age; (2) were recommended insulin therapy by a clinician but were not actually taking insulin or had been undergoing insulin therapy for less than one year (self-report); (3) were able to communicate in Korean; (4) and had an A1C level of 7.0% or higher (measured within the past three months, as revealed by medical records) and were recommended insulin therapy. The exclusion criteria were (1) being on in-

sulin injection therapy for one year or longer; (2) being diagnosed with type 2 diabetes while on psychotropic drugs; and (3) having difficulties in understanding questions or expressing intention.

3. Instruments

The authors obtained permission to use the Korean version of the PIR scale (K-PIR), Diabetes Self-Efficacy Scale (DSES), and the Korean version of SDSCA from the original developers and Korean author via e-mail.

1) PIR

We used the K-PIR, an 18-item scale developed and validated by Song et al. [18]. Two factors in the K-PIR, cognitive psychological factors (14 items) and supportive factors (4 items), explained 41.8% of the total variation [18].

For example, items on cognitive psychological factors include "I think insulin treatment seems like the last resort" and "Injecting insulin in public can be embarrassing." An example of an item on supportive factors is "Treatment can be an economic burden." All 18 items were scored on a five-point Likert scale, with total scores ranging from 18 to 90. Higher scores indicate greater levels of PIR. The reliability at the time of development by Song et al. [18], expressed in terms of Cronbach's α, was .91; it was .91 in the current study as well.

2) DSE

We used the DSES, developed by Rapley et al. [19]. The DSES is based on the Insulin Management Diabetes Self-Efficacy Scale by Hurley [20], and was translated, modified, and supplemented by Jun et al. [21]. The scale is composed of 18 items in five subscales: diet, self-treatment, routines, certainty, and exercise. Responses are scored on a six-point Likert scale, with scores ranging from 18 to 108; higher scores indicate greater confidence in diabetes self-management. The reliability (Cronbach's α) at the time of development by Rapley et al. [19] ranged from .61 to .76, whereas in Jun et al.'s study [21] it ranged from .64 to .80, and in the present study it was .89.

3) DSCM

We used the Korean version of the SDSCA scale, originally developed by Toobert et al. [22]. Song et al. undertook the Korean translation and reliability testing [23]. The instrument comprises 16 items. A higher score indicates better DSCM. Cronbach's α at the time of development by Toobert et al. was .77 [22], .68 in the study by Song et al. [23], and .65 in this study.

4) Data collection

In the parent study, data were collected from December 2015 to March 2016. Prior to gathering the data, permission was obtained from the hospital and public health care center. The survey was conducted by a trained research assistant. Data collection was conducted face-to-face in a separate room onsite at each venue. Questionnaires were submitted anonymously. After completion of the survey, participants were given a gift as compensation for their time.

5) Ethical considerations

This study was a part of a parent study. Apart from the approval for parent study, for this study, we received the approval from the institutional review board of the College of Nursing, Chungnam National University (No. 2-1046881-A-N-01-201612-HR-059-09). All participants provided written informed consent.

6) Statistical analysis

Descriptive statistics were used for sociodemographic and disease-related characteristics, PIR, DSE, and DSCM. Pearson's correlation coefficient were obtained to examine correlations among the variables (PIR, DSE, and DS CM). The factors that were associated with DSCM were analyzed using the hierarchical multiple regression model. Model 1 included sociodemographic and disease-related characteristics. PIR and DSE were added in Model 2. Statistical significance was set at α=.05 (two-sided).

RESULTS

1. Sample Characteristics

The mean age of the 192 participants was 63.5±10.9 years. The majority were male (n=108, 56.3%), religious (n=115, 59.9%), and high school graduates (n=98, 51.0%), as shown in Table 1. Eighty-two participants (42.7%) reported having a high economic status. Seventy-two participants (37.5%) had a body mass index of 25 kg/m^2 or above. A total of 168 participants (87.5%) were nonsmokers, 83 (43.2 %) reported an "average" self-rated health status, and 122 (63.5%) had no experience of insulin education. The average duration of having diabetes was 11.51±9.41 years.

2. Correlations among DSE, PIR, and DSCM

A significant negative correlation (r=-.19, p=.010) was found between DSCM and PIR. However, the correlation between DSE and PIR was non-significant (r=.01, p=.900),

as shown in Table 2. A significant positive correlation (r=.56, $p<.001$) was found between DSCM and DSE.

3. Predictors of DSCM

To identify the main related factors of DSCM, we entered the general characteristics of participants (i.e., gender, whether they were religious, educational level, financial status, body mass index, smoking status, self-rated health status, and experience of insulin education) in the first step of the regression analysis, with DSCM as the dependent variable. PIR and DSE were entered in the second step to analyze their independent relationships with DSCM (while controlling for general characteristics). The analysis results are shown in Table 3. Before conducting the analysis, we confirmed the basic assumptions of regression analysis. We found no significant autocorrelation in the residuals, with a Durbin-Watson value of 1.756. We also found no significant multicollinearity: the tolerance values were .696~.917, and the variance inflation factors were 1.090~1.480 (i.e., less than 10).

The first multivariate model was significant (F=2.86, $p<.001$) and accounted for 16.0% of the variance in DSCM. The specific general characteristics with significant relationships with DSCM were whether participants were religious ($p=.028$), their body mass index ($p=.012$), and experience of insulin education ($p=.002$). We observed a significant change (F=9.16, $p<.001$) in variance when PIR

Table 1. Demographic Characteristics of the Participants (*N*=192)

Characteristics	Categories	n (%)	M±SD
Age (year)			63.5±10.9
Gender	Women	84 (43.8)	
	Men	108 (56.3)	
Religious background	Yes	115 (59.9)	
	No	77 (40.1)	
Education	Below elementary school	48 (25.0)	
	Middle school	46 (24.0)	
	Above high school	98 (51.0)	
Self-rated economic status	Low	35 (18.2)	
	Middle	75 (39.1)	
	High	82 (42.7)	
BMI, kg/m^2	<23	64 (33.3)	24.72±3.48
	23~24.9	56 (29.2)	
	≥25	72 (37.5)	
Smoking	Yes	24 (12.5)	
	No	168 (87.5)	
Perceived health status	Unhealthy	72 (37.5)	
	Moderate	83 (43.2)	
	Healthy	37 (19.3)	
Self-reported experience of insulin education	Yes	70 (36.5)	
	No	122 (63.5)	
Duration of diabetes (year)			11.51±9.41

Table 2. Correlations among Psychological Insulin Resistance, Diabetes Self-Efficacy, and Diabetes Self-Care in Patients with Type 2 Diabetes

Variables	PIR	DSE	DSCM
	r (*p*)	r (*p*)	r (*p*)
PIR	1		
DSE	.01 (.900)	1	
DSCM	-.19 (.010)	.56 (<.001)	1

PIR=psychological insulin resistance; DSE=diabetes self-efficacy; DSCM=diabetes self-care management.

Table 3. Factors associated with Diabetes Self-Care Management in Patients with Type 2 Diabetes (*N*=192)

Models	Factors	Standardized β	95% CI	*p*	R^2	F (*p*)
1	Gender (1=Women 0=Men)	-.01	-4.60~4.04	.899	0.16	2.86 (<.001)
	Religious (1=Yes, 0=No)	.16	0.47~8.36	.028		
	Education	-.01	-2.50~2.15	.880		
	Economic status	.08	-1.13~3.99	.273		
	BMI	-.18	-5.10~-0.63	.012		
	Smoking (1=Yes, 0=No)	-.15	-12.13~0.31	.062		
	Perceived health status	.12	-0.47~4.73	.107		
	Experience of insulin education (1=Yes, 0=No)	-.23		.002		
2	Gender (1=Women 0=Men)	.00	-3.65~3.71	.986	0.42	9.16 (<.001)
	Religious (1=Yes, 0=No)	.19	1.81~8.41	.003		
	Education	-.07	-3.06~0.85	.268		
	Economic status	.03	-2.71~1.73	.662		
	BMI	-.07	-3.07~0.75	.234		
	Smoking (1=Yes, 0=No)	-.11	-9.79~0.64	.085		
	Perceived health status	.01	-2.09~2.34	.912		
	Experience of insulin education (1=Yes, 0=No)	.12	-0.53~6.93	.092		
	PIR	-.20	-0.28~-0.52	.004		
	DSE	.53	0.33~0.53	<.001		

BMI (kg/m^2)=body mass index; CI=confidence interval; DSCM=diabetes self-care management; DSE=diabetes self-efficacy; PIR=psychological insulin resistance.

and DSE were added in the second model: the explanatory power jumped to 42.0%, representing a 26.0% increase compared to the first model. Among participants' general characteristics, only whether they were religious (p=.003) remained significant in the second model. Both PIR (p=.004) and DSE (p<.001) were significantly related to DSCM.

DISCUSSION

According to the main results of the present study, the likelihood of engaging in a given self-care management plan was higher when an individual's self-efficacy was high and perceived barriers to use of insulin were low. In Larkin et al.'s study on patients with type 2 diabetes [24], the level of PIR was affected by willingness to take insulin. In other words, even if patients were prescribed insulin therapy by their physicians, their unwillingness could lead to PIR. In the process of accepting insulin therapy, the patient experiences psychological difficulties (low self-efficacy and high PIR), which can affect diabetes self-care. In the study by Larkin et al. [24], the level of PIR was lower in patients with type 2 diabetes who were adherent to taking insulin than non-adherent patients.

Funnell et al. [15] stated that overcoming PIR at the beginning of insulin therapy is important for sustaining DSCM. This was confirmed by our finding that PIR functioned as a barrier to DSCM. Decreasing psychological insulin resistance might help improve the quality of life by reducing the likelihood of non-adherence in type 2 diabetes. Therefore, if PIR is evaluated at the time of diabetes education for patients who have been recommended insulin therapy, efforts can be made to reduce that resistance. Education and follow-up care strategies to reduce PIR and improve self-efficacy are necessary to motivate better self-care management, which is essential to achieve effective glycemic control and reduce complications.

The findings were consistent with those of previous studies [8,25] reporting that higher DSE is associated with better DSCM. Kuo et al. [26] stated that for patients who are about to begin insulin therapy, PIR can be lowered and intention to take insulin therapy can be increased by skilled nurses via group education. Overcoming PIR at the outset is important for sustaining insulin therapy and maintaining DSCM, even if patients have already decided to take insulin therapy. Nurses must, therefore, be given an expanded role in diabetes treatment in order to promote DSCM among patients with high PIR. This can be achieved by expanding nurses' own understanding of nursing research, practice, and patient assessment, and training them in providing individualized education to reduce PIR.

Currently, education for patients with diabetes and interventional research are actively being conducted to promote DSCM. Among the interventions being researched is a program aiming to improve patients' knowledge of diabetes and DSCM using online resources or mobile phones [27], which has proven to be effective. The sustained effect of such interventions, however, remains uncertain [28,29]. Studies have shown that individualized education-that is, programs that consider the social and psychological sit-

uations of each individual patient with chronic illness-can have a greater effect; therefore, it is necessary to comprehensively evaluate the emotional, supportive, and cognitive situations of patients with diabetes before they are provided with education. Basing educational programs on such evaluations may produce greater effects regarding self-care maintenance. This evaluation step can include measurements of PIR, including comprehensive considerations of the emotional, supportive, and cognitive situations of patients. In addition, the maintenance of DSCM can be expected only if the patients are deeply understood of the program, there is good communication between the patients and nurses (i.e., interaction and feedback), and the education is interactive rather than one-sided [24,27, 29-31].

The PIR scale used in this study breaks down the construct into negative emotional, cognitive, and supportive factors. Accordingly, it can be a useful instrument for identifying the specific areas in which patients experience difficulties. For instance, when incorrect perceptions of the disease must be corrected, the educational content on general illness can be altered accordingly.

The limitations of this study were as follows. First, it was conducted with a relatively small homogeneous group in South Korea. Therefore, the study needs to be replicated on a larger scale with a more diverse group to generalize the findings. Second, the study measured only PIR and DSE. After the patients' own PIR and DSE are evaluated, if they require help with their diet, shopping, and other everyday life matters, then the PIR and DSE of care providers, whose social support, psychological situation, or mental situation would also influence DSCM, must also be evaluated. Finally, attributes of PIR differ by cultures; therefore, our findings cannot be generalized to patients from other ethnic and cultural backgrounds. Further research is necessary to validate our findings because the proportion of variation in the K-PIR was low in this study. Moreover, in the present study, having a religious background or preference was associated with DSCM, but there is little evidence to explain it. Along with culture, religion may be associated with self-care management of chronic conditions, but further evidence is necessary.

CONCLUSION

This study examined the associations among PIR, DSE, and DSCM in Korean patients with type 2 diabetes. PIR and DSE were the important predictors of DSCM for patients who were recommended insulin therapy. Particularly, this study was the first to show that PIR in Korean patients with type 2 diabetes is a barrier to diabetes self-care. Therefore, PIR should be further investigated and considered in clinical efforts to promote DSCM among patients with type 2 diabetes. Nurses should be entrusted with health education in order to improve DSCM. Validating these findings in other populations and with larger samples might establish PIR as an important construct in the self-care management of patients with chronic diseases.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

Study conception and design acquisition - SY; Data collection - KB; Analysis and interpretation of the data - KB and SY; Drafting of the manuscript - KB and SY; Critical revision of the manuscript - SY and KJI.

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