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RESEARCH ARTICLE

Factors Related to Self-care in Patients with Type 2 Diabetes

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Abstract:

Purpose:

The prevalence of diabetes and the personal and national burden from diabetes, a serious health issue around the globe, continues to increase. The purpose of this study was to identify factors influencing self-care among patients with type 2 diabetes.

Methods:

We conducted a cross-sectional descriptive survey of 118 outpatients with type 2 diabetes in national university hospital C in Korea. Data were collected from self-report questionnaires covering information on demographics, self-care, and self-efficacy. Additional data were collected from medical records including information on HbA1c, fasting blood glucose levels, and cholesterol levels. Collected data were analyzed using descriptive statistics, Pearson's correlation coefficient, and multiple regression using SPSS/WIN version 22.0 software.

Results:

Factors affecting self-care were the following four: self-efficacy, HbA1c, occupation status, and smoking status. Higher engagement in self-care was associated with higher self-efficacy ($\beta = .53$, $p < .001$), lower HbA1c ($\beta = -0.33$, $p < .001$), unemployment ($\beta = -0.20$, $p < .001$), and non-smoking status ($\beta = -0.15$, $p = .011$). The regression model of self-care among the type 2 diabetes patients was statistically significant ($F = 67.15$, $p < .001$), and the explanatory power of the adjusted R^2 was 69%.

Conclusion:

Type 2 diabetes patients with high self-efficacy and self-care scores showed good glycemic control. Therefore, this finding suggests that nursing interventions should be developed to enhance self-efficacy, which is the greatest influencing factor for self-care.

Keywords: Type 2 diabetes, Self-care, Self-efficacy, HbA1c, FBG, Cholesterol, Glycemic control.

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1. INTRODUCTION

1.1. Research Background

The prevalence of diabetes, a serious health issue around the globe, continues to increase. According to the International Diabetes Federation, 8.2% of adults aged between 20 and 79 years old are currently diagnosed with the disease. This amounts to 387 million people living with diabetes in the world, with projections that the prevalence will increase to 592 million by 2035 [1]. In Korea, diabetes is estimated to affect 5,010,000 adults aged 30 years or older (14.4%) and the number continues to rise [2]. Diabetes ranked sixth in the leading causes of death in 2016 [3]. As of 2016, diabetes treatment expenses accounted for 7.8% of all treatment costs for chronic diseases in Korea, and had increased by 12.4% compared to the previous year [4]. Accordingly, the personal and national burden from diabetes appears to be consistently increasing. The World Health Organization (WHO) has declared diabetes as one of the four non-contagious diseases that need close monitoring [5].

The primary goals in the management of type 2 diabetes are to prevent complications of microvascular and macrovascular diseases by strictly monitoring blood glucose levels, and to reduce the fatality rate and costs of treating diabetes by slowing down the progression of complications, thereby ultimately improving the quality of life [6]. Properly controlling blood glucose levels, including fasting blood glucose level and glycated hemoglobin (HbA1c), is highly

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recommended as the most effective way to achieve such goals. However, the status of diabetes management in 2018 showed that only 26% of diabetic patients in Korea maintained a HbA1c level below 6.5%, the level recommended by the Korean Diabetes Association [2].

The American Diabetes Association also highly recommends adopting healthy eating and exercise habits, regular self-monitoring of one's blood glucose level, and faithfully following healthcare providers' treatment plans, such as medication or injection regimens for effective blood glucose control, in addition to managing aspects of emotional health such as stress [6]. Self-care activities have been reported in many studies to be major factors affecting blood glucose levels. According to the National Sample Survey conducted in Korea, however, 61% of diabetic patients never received education on the disease, 65% do not self-monitor their blood glucose levels, 41% of male patients with diabetes smoke, and 44.5% consume alcohol more than once per week, all of which indicate poor self-care [7]. Hence, measures for improving self-care among patients are urgently needed so that patients can reach their targeted blood glucose levels to prevent complications and independently carry out everyday tasks, thereby improving their quality of life and satisfaction with life.

Self-efficacy related to diabetes refers to patients' confidence that they can successfully execute self-care according to the recommended treatment methods [8]. It is reported to be an important factor for successful self-care and changes in health-improving behaviors among patients with type 2 diabetes [9] [10]. In the previous studies, self-efficacy has been known to be a variable that directly and significantly affects the implementation of self-care [11]. High self-efficacy was found to lead to a higher rate of implementation of self-care, thus having a positive influence on the changes in and maintenance of health behaviors [12].

Therefore, this study aims to identify physiological indices through medical records and measurements of self-care and self-efficacy for the management of type 2 diabetes and to investigate the factors affecting self-care.

1.2. Purpose of Research

The purpose of this study is to identify the factors affecting self-care among patients with type 2 diabetes so as to provide basic materials to develop nursing interventions that will improve self-care skills among type 2 diabetes patients. The detailed purposes are as follows:

- Identify self-care, self-efficacy, HbA1c, fasting blood glucose, and cholesterol levels among patients with type 2 diabetes.
- Identify the differences in self-care according to general characteristics of patients with type 2 diabetes.
- Investigate the correlation among self-care, self-efficacy, body mass index (BMI), HbA1c, fasting blood glucose, and cholesterol levels among patients with type 2 diabetes.
- Investigate the factors affecting self-care among patients with type 2 diabetes.

2. METHOD

2.1. Research Design

The research design adopted in this study was descriptive research aimed to identify self-care, self-efficacy, HbA1c, fasting blood glucose, and cholesterol levels among patients with type 2 diabetes and to investigate factors affecting self-care.

2.2. Participants

Participants were selected using convenience sampling from outpatients with type 2 diabetes who visited the endocrinology department at a university hospital located in city C. Inclusion criteria were adults over 18 years of age who had been diagnosed with type 2 diabetes for over 1 year. Patients with mental and psychological problems and illiteracy were excluded. It was ensured that participants understood the purpose of this research, provided written consent to participate, and could communicate freely, comprehend the questionnaires, and provide answers. G*Power 3.1 was used to obtain the sample size of 118. A multiple regression analysis performed with a significance level of 0.05 resulted in an effect size of 0.15, a statistical power of 0.80, and 10 predictor variables. Data were collected until 118 participants were selected from among the outpatients who did not withdraw.

2.3. Research Tool

The survey used in this study consisted of 16 questions on general characteristics, 40 questions on self-care, 17 questions on self-efficacy, and 4 questions on physiological indices. The tools for measuring self-care and self-efficacy for type 2 diabetes were used after receiving permission from the authors.

2.3.1. General Characteristics

Sociodemographic characteristics of the participants included gender, age, marital status, educational level, employment status, income level, caregiver status, and drinking and smoking status. Disease-related characteristics consisted of the period of being diagnosed with type 2 diabetes, complications, number of hospitalizations due to diabetes, family history of diabetes, previous experience of receiving education on diabetes, treatment methods, and comorbid conditions.

2.3.2. Self-care

The tool for measuring self-care was a modified Korean version of the Self Care of Diabetes Inventory (SCODI) developed by Ausili *et al*. [13] for patients with type 1 and 2 diabetes, based on the middle-range theory on self-care of chronic diseases and clinical recommendations. The original tool was translated into Korean for this study and its validity was verified by experts, which was followed by back translation, author's translation, and back translation again in order to be used. Prior to translating the tool, permission to translate the tool into Korean and use it was obtained from its author. The first translation was performed by a professional translation agency with extensive experience in the field. Subsequently, one English professor validated the accuracy of

the translation and its conformity to the original, and then the validity of the survey questions was verified twice by experts. The first verification was carried out by a group of experts consisting of three professors in the department of endocrinology, one professor in the department of nursing, and one diabetes specialist nurse. The experts examined whether each question was valid for self-care for diabetes and indicated whether the adaptation in Korean was valid by scoring the questions from 1 to 4, with 1 being "not valid at all" and 4 being "highly valid." The experts were asked to provide explanations of needed modifications to items that were scored either 1 or 2. Subsequently, an Item-Content Validity Index (I-CVI) was calculated for each question, of which 13 questions with 0.80 or less were examined and revised in terms of word choice or context based on the explanations provided by the experts. The secondary verification for these questions was conducted by a group of experts consisting of two professors in the department of endocrinology, one professor in the department of nursing, and one diabetes specialist nurse. All 40 questions had an I-CVI of 0.80 or higher, which indicated that all questions were verified valid. Then, a professional translation agency was requested to back translate, and the questions were finalized after verifying that the questions in back translation and in the original tool conveyed the same meaning. Last, the process of translating the SCODI tool into Korean was explained to the author, and he verified that the translated tool was valid *via* translation and back translation, providing final confirmation. This tool consists of a total of 40 questions in four subcategories, including 12 questions on self-care maintenance, 8 questions on self-care monitoring, 9 questions on self-care management, and 11 questions on self-care confidence. Using a 5-point Likert scale, self-care maintenance, self-care monitoring, and self-care management were scored from 1 ("not at all") to 5 ("always"). For self-care confidence, a score of 1 indicated "not confident at all" and 5 indicated "confident in everything"; higher scores indicated better self-care. For self-care management, however, question number 29 ("If you find out that your blood glucose is too high or too low, do you adjust your insulin dosage in the way your health care provider suggested?") was intended to be answered only by those who were receiving insulin injections. Participants who did not receive insulin injections were excluded. The score on the SCODI tool was converted to a 100-point scale; for participants who received insulin injections, scores were converted based on 40 questions, whereas those who were not receiving insulin injections had their scores converted based on 39 questions. The reliability (Cronbach's α) of the original tool [13] was 0.81 for self-care maintenance, 0.84 for self-care monitoring, 0.86 for self-care management, and 0.89 for self-care confidence at the time of development, while Cronbach's α in this study was 0.77 for self-care maintenance, 0.68 for self-care monitoring, 0.74 for self-care management, and 0.90 for self-care confidence.

2.3.3. Self-efficacy in Diabetes Management

We used the tool entitled the Diabetes Management Self-efficacy Scale for Old Adults (DMSES-O), which was developed by Song *et al*. [14] based on the seven self-care criteria [15] suggested by the American Association of Diabetes Educators and the standard guidelines for diabetes self-care [16] suggested by the American Diabetes Association, for which validity has been verified. The DMSES-O has a total of 17 questions in six subcategories, including four questions on blood glucose monitoring and solving the problem of hypoglycemia, two questions on solving the problem of hyperglycemia, three questions on coping with injection and psychological difficulty, four questions on following treatments to prevent complications, two questions on adequate exercise, and two questions on pursuing a healthy diet. Based on a 4-point Likert scale, questions were scored from 1 to 4, with 1 being "not confident at all" and 4 being "very confident." Higher scores indicated better self-efficacy. The original tool [14] had a Cronbach's α of 0.84 at the time of development and 0.91 in this study.

2.3.4. Physiological Indices

In this study, the physiological indices associated with diabetes included BMI, HbA1c, fasting blood glucose, and total cholesterol level. The most recent measurements from the medical records were collected.

After permission was received from the IRB for EMR access, the medical records of the subjects were reviewed using the electronic medical record (EMR), a computerized medical records inquiry program. Each patient's medical record number and physiological indices that met the inclusion criteria were stored in a separate file under the guardianship of the researcher and coded.

2.4. Data Collection

Data were collected from November 15, 2018, to April 30, 2019. after explaining the purpose and process of this research to and obtaining consent from the department of nursing and professors in the department of endocrinology of national university hospital C, in Chungbuk province, South Korea. Data collection was performed by a research assistant who was a fourth-year student in the department of nursing; it took place in the outpatient ward in the department of endocrinology. In order to meet with patients before and after the consultation, cooperation was sought from the nurses in the department of endocrinology. The researcher checked the list of outpatients who had appointments in order to select the participants, and the research assistant then collected data from patients with type 2 diabetes who had visited the hospital. The researcher explained to the endocrinology outpatient nurse the inclusion and exclusion criteria for selecting from among scheduled outpatients during the data collection period, confirmed which patients met the criteria based on their medical records, and notified the research assistant. Then, the research assistant explained the purpose and process of this study to the participants, obtained written consent, and explained to the participants how to complete the survey on their own. In the event that participants were unable to complete the survey on their own, the research assistant read the questions out loud and had them write their answers, or the research assistant wrote the answers if they responded verbally. The research assistant remained with the participants while they completed the survey to answer any questions or provide necessary assistance. The survey took approximately 15–20 minutes to complete, and a

small gift was provided to each participant as a token of gratitude.

2.5. Ethical Considerations

This study obtained approval (IRB File No. CBNUH 2018-10-020) from the institutional review board of the site hospital. The research explanation section described the purpose, participants, and details of this study, while it was clearly explained that anonymity and personal information protection were guaranteed and that participants could withdraw from the study at any time even after they had consented to participate. Contact information (phone number and email address) was included to allow the participants to contact the researcher if they had questions regarding the study. Participants read the explanation and provided written consent before directly completing the survey. The researcher then collected, organized, and analyzed the data.

2.6. Data Analysis

The collected data were analyzed using SPSS/WIN 22.0 (IBM SPSS statistics version 22, IBM Inc, Chicago, IL, USA). Frequencies and percentages were calculated for sociodemographic characteristics as well as health and disease-related characteristics of the participants. Means and standard deviations were analyzed using descriptive statistics for self-care, self-efficacy, HbA1c, fasting blood glucose and cholesterol levels. The differences in self-care according to the participants' sociodemographic characteristics and health and disease-related characteristics were analyzed using the independent t-test and one-way ANOVA test. Scheffé's test was performed as a post hoc test. The correlation between the participants' self-care, self-efficacy, BMI, HbA1c, fasting blood glucose, and cholesterol levels was analyzed using Pearson's correlation coefficient. The factors influencing self-care were analyzed using stepwise multiple regression.

3. RESULTS

3.1. Characteristics of the Participants

The total number of participants in this study was 118, of whom 69 (58.5%) were male and 67 (56.8%) were aged 60 years or older. The average age of the participants 59.70 ± 12.25 years old. 100 participants were married (84.7%), high school degrees or higher had been obtained by 84 participants (71.2%), the total number employed was 51 (43.2%), a total of 101 (85.6%) had an income level of "middle" or higher, and 75 (63.6%) had a primary caregiver. With respect to health and disease-related characteristics of participants, 51 participants (43.2%) consumed alcohol and 22 (18.6%) smoked. The number of participants with a BMI of 23 kg/m^2 or higher was 87 (73.7%), and the average BMI was 25.77 ± 4.60 kg/m^2. In addition, 62 participants (52.5%) had been diagnosed with diabetes less than 10 years prior to the study, and the average duration of disease experience was 10.89 ± 7.69 years. Further, 58 participants had experienced complications (49.2%), and 27 (22.9%) had experienced hospitalization due to diabetes. Family history of diabetes was found among 41 participants (34.7%), and 38 (32.2%) had received education on diabetes previously. For treatment, most of the participants - 99 of 118 (83.9%) - were taking an oral hypoglycemic agent (OHA). The average number of comorbid conditions was 1.36 ± 0.88, and 98 participants (83.1%) had one or more conditions occurring simultaneously. The average HbA1c was 7.30 ± 1.32. Only 23 participants (19.5%) maintained HbA1c below 6.5, the figure recommended by the Korean Diabetes Association. The average fasting blood glucose was 140.54 ± 42.23, and 53 participants (44.9%) maintained levels below 130. The average cholesterol level was 157.15 ± 33.10, and 108 participants (91.5%) maintained a level below 200 (Table **1**).

Table 1. Characteristics of the participants (N = 118).

Characteristics	Categories	N	%	Mean±SD
Gender	Female	49	41.5	-
-	Male	69	58.5	-
Age (years)	< 60	51	43.2	48.47±7.92
-	≥ 60	67	56.8	68.25±6.83
Marital status	Married	100	84.7	-
-	The others	18	15.3	-
Education	≤ Middle school	34	28.8	-
-	≥ High school	84	71.2	-
Occupation	Unemployed	67	56.8	-
-	Employed	51	43.2	-
Economic status	Low	17	14.4	-
-	≥ Middle	101	85.6	-
Caregiver	No	43	36.4	-
-	Yes	75	63.6	-
Drinking	No	67	56.8	-
-	Yes	51	43.2	-
Smoking	No	96	81.4	-
-	Yes	22	18.6	-
BMI (kg/m^2)	< 18.5	5	4.2	17.37±0.57

(Table 1) contd.....

-	18.5~22.9	26	22.0	21.33±1.03
-	≥ 23	87	73.7	27.59±3.88
Duration of disease experience (years)	< 10	62	52.5	5.08±2.60
-	≥ 10	56	47.5	17.32±6.18
Complication of diabetes	No	60	50.8	-
-	Yes	58	49.2	-
Experience of hospitalization with diabetes	No	91	77.1	-
	Yes	27	22.9	-
Family history of diabetes	No	77	65.3	-
-	Yes	41	34.7	-
Experience of diabetes education	No	80	67.8	-
-	Yes	38	32.2	-
Treatment modality	OHA	99	83.9	-
-	Insulin	15	12.7	-
-	OHA & insulin	4	3.4	-
Comorbidity	0	20	16.9	-
-	≥1	98	83.1	1.36±0.88
HbA1c (%)	< 6.5	23	19.5	5.86±0.30
-	≥ 6.5	95	80.5	7.65±1.23
FBG (mg/dL)	< 130	53	44.9	109.79±14.43
-	≥ 130	65	55.1	165.62±40.86
Cholesterol (mg/dL)	< 200	108	91.5	151.46±27.93
-	≥ 200	10	8.5	218.60±19.74

Notes. BMI: Body Mass Index, HbA1c: glycosylated hemoglobin, FBG: fasting blood glucose, OHA: oral hypoglycemic agents, SD: standard deviation.

Table 2. Descriptive statistics for self-care, self-efficacy, hba1c, fbg, and cholesterol (N = 118).

Variables		Score Range	Total	OHA (n = 99)	Insulin (n = 19)
			Mean±SD	Mean±SD	Mean±SD
Self-care		0 ~100	68.74±15.76	69.34±15.67	65.59±16.27
Confidence	0 ~100	78.66±19.18	79.38±19.07	74.88±19.81	
Maintenance	0 ~100	72.51±16.99	73.51±17.28	67.32±14.72	
Monitoring	0 ~100	65.30±19.19	66.04±18.71	61.46±21.68	
Management	0 ~100	55.21±24.36	54.72±24.47	57.75±24.26	
Self-efficacy		17~68	53.50±9.60	54.05±9.78	50.63±8.23
HbA1c (%)		-	7.30±1.32	7.16±1.17	8.03±1.79
FBG (mg/dL)		-	140.54±42.23	140.99±38.24	138.21±60.21
Cholesterol (mg/dL)		-	157.15±33.10	156.74±42.02	157.15±33.10

Notes. OHA: oral hypoglycemic agents, HbA1c: glycosylated hemoglobin, FBG: fasting blood glucose; SD: standard deviation.

3.2. Self-care, Self-efficacy, HbA1c, Fasting Blood Glucose, and Cholesterol

The average self-care score was 68.74 ± 15.76 out of 100. Among the subcategories of self-care, the score was highest for self-care confidence at 78.66 ± 19.18, followed by self-care maintenance at 72.51 ± 16.99, self-care monitoring at 65.30 ± 19.19, and self-care management at 55.21 ± 24.36. The average self-efficacy score was 53.50 ± 9.60 out of 68. The average HbA1c was 7.30 ± 1.32%, the average fasting blood glucose was 140.54 ± 42.23 mg/dL, and the average cholesterol level was 157.15 ± 33.10 mg/dL. OHA patients had higher self-care and self-efficacy and lower HbA1c than insulin patients (Table **2**).

3.3. Differences in Self-care According to the Participants' Characteristics

Results indicated that female had a higher self-care score than male (t = 2.29, p = .024), participants aged 60 years or older had a higher self-care score than those aged below 60 years old (t = -4.05, p < .001), unemployed participants had a higher self-care score than those who were employed (t = 4.20, p < .001), and those who did not smoke had a higher self-care score than those who smoked (t = 4.84, p < .001). Furthermore, participants with an HbA1c of 6.5% or higher had a higher self-care score than those with an HbA1c less than 6.5% (t = 7.34, p < .001). Participants with fasting blood glucose levels less than 130 had a higher self-care score than those with fasting blood glucose levels of 130 or higher (t = 4.55, p < .001) (Table **3**).

3.4. Correlations Among self-care, Self-efficacy, BMI, HbA1c, Fasting Blood Glucose, and Cholesterol

Self-care had a positive correlation with self-efficacy (r = 0.72, p < .001) and negative correlations with HbA1c (r = -0.56, p < .001) and fasting blood glucose (r = -0.47, p < .001). Moreover, self-efficacy had negative correlations with HbA1c (r = -0.35, p < .001) and fasting blood glucose (r = -0.39, p < .001). HbA1c had a positive correlation with fasting blood glucose (r = 0.56, p < .001) (Table **4**).

3.5. Factors Affecting Self-care Among Patients with Type 2 Diabetes

To perform regression analysis, multicollinearity of independent variables and autocorrelation of dependent variables were examined. The correlation coefficient of independent variables was between 0.20–0.72 (which is less than 0.80), while the tolerance was between 0.81–0.87 (which is greater than 0.10). The variance influence factor (VIF) was between 1.15–1.24, which did not exceed 10 and thus proved that multicollinearity of the independent variable was not a cause for concern. In addition, the Durbin–Watson statistic exhibited a value of 2.20, which was close to the threshold of 2.0 and thus proved that autocorrelation of dependent variables was not present. To identify the factors affecting self-care, a stepwise multiple regression analysis was performed by taking categorical variables, gender, age, employment, smoking, HbA1c, and fasting blood glucose levels that were statistically significant for self-care in a univariate analysis as dummy variables to be entered as independent variables along with self-efficacy, which was statistically significant in a correlation analysis, as an independent variable. The primary factors affecting self-care were self-efficacy, HbA1c, employment, and smoking. Participants with higher self-efficacy (β = 0.53, p <.001) and lower HbA1c (β = -0.33, p <.001) and those who were unemployed (β = -0.20, p <.001) and did not smoke (β = -0.15, p =.011) had better self-care skills. The regression model of self-care with these four variables was statistically significant (F = 67.15, p <.001), and the explanatory power of a correction model was 69% (Table **5**).

Table 3. Differences in self-care according to the characteristics of the participants (N = 118).

Characteristics	Categories	Self-care	
		Mean±SD	t or F (p)
Gender	Female	72.49±13.74	2.29 (.024)
-	Male	66.07±16.64	-
Age (years)	< 60	62.25±16.38	-4.05 (<.001)
-	≥ 60	73.67±13.41	-
Marital status	Married	69.29±15.15	-0.77 (.448)
-	The others	65.64±18.99	-
Education	≤ Middle school	70.98±14.97	0.98 (.327)
-	≥ High school	67.83±16.07	-
Occupation	Unemployed	73.93±11.90	4.20 (<.001)
-	Employed	61.91±17.62	-
Economic status	Low	68.99±12.26	0.07 (.942)
-	≥ Middle	68.69±16.33	-
Caregiver	No	67.58±16.82	-0.60 (.550)
-	Yes	69.40±15.20	-
Drinking	No	70.01±13.50	0.97 (.337)
-	Yes	67.06±18.32	-
Smoking	No	71.81±14.00	4.84 (<.001)
-	Yes	55.30±16.26	-
BMI (kg/m^2)	< 18.5	67.95±18.04	0.01 (.986)
-	18.5~22.9	68.44±18.32	-
-	≥ 23	68.87±15.00	-
Duration of disease experience (years)	< 10	66.26±17.66	1.84 (.069)
-	≥ 10	71.47±12.96	-
Complication of diabetes	No	69.98±15.58	0.87 (.387)
-	Yes	67.45±15.98	-
Experience of hospitalization with diabetes	No	70.38±14.43	1.83 (.076)
	Yes	63.19±18.85	-
Family history of diabetes	No	67.16±16.98	-1.62 (.108)
-	Yes	71.69±12.85	-
Experience of diabetes education	No	68.74±15.50	0.01 (.998)
-	Yes	68.73±16.51	-
Treatment modality	OHA	69.34±15.67	0.45 (.640)

(Table 3) contd.....

-	Insulin	65.50±17.73	-
-	OHA & insulin	65.94±11.06	-
Comorbidity	0	70.99±14.79	0.70 (.484)
-	≥1	68.27±15.98	-
HbA1c (%)	< 6.5	81.46±6.80	7.34 (<.001)
-	≥ 6.5	65.66±15.79	-
FBG (mg/dL)	< 130	75.37±12.75	4.55 (<.001)
-	≥ 130	63.33±16.00	-
Cholesterol (mg/dL)	< 200	68.80±15.89	0.16 (.877)
-	≥ 200	67.99±15.12	-

Notes. BMI: Body Mass Index, HbA1c: glycosylated hemoglobin, FBG: fasting blood glucose, OHA: oral hypoglycemic agents, SD: standard deviation.

Table 4. Correlations among self-care, self-efficacy, bmi, hba1c, fbg, and cholesterol (N = 118).

Variables	Self-care	Self-efficacy	BMI	HbA1c	FBG
	r (*p*)				
Self-efficacy	0.72 (<.001)	-	-	-	-
BMI (kg/m^2)	-0.10 (.277)	-0.09 (.313)	-	-	-
HbA1c (%)	-0.56 (<.001)	-0.35 (<.001)	0.10 (.299)	-	-
FBG (mg/dL)	-0.47 (<.001)	-0.39 (<.001)	0.05 (.577)	0.56 (<.001)	-
Cholesterol (mg/dL)	-0.06 (.518)	-0.11 (.259)	0.13 (.152)	0.02 (.830)	0.01 (.910)

Notes. BMI: Body Mass Index, HbA1c: glycosylated hemoglobin, FBG: fasting blood glucose.

Table 5. Factors affecting self-care in patients with type 2 diabetes (N = 118).

Variables	B	SE	β	*t*	*p*
Constant	54.32	8.07	-	6.73	<.001
Self-efficacy	0.88	0.09	0.53	9.44	<.001
HbA1c (%)	-3.92	0.66	-0.33	-5.97	<.001
Occupation (reference = No)	-6.34	1.76	-0.20	-3.61	<.001
Smoking (reference = No)	-5.92	2.29	-0.15	-2.58	.011
-	Adjusted R^2 = .69, F = 67.15, p < .001				

Notes. HbA1c: glycosylated hemoglobin, SE: standard error.

4. DISCUSSION

Factors affecting self-care must be identified first in order for type 2 diabetic patients to control their blood glucose levels and prevent complications. In this study, therefore, we examined how constant variables such as sociodemographic and clinical characteristics and random variables such as self-efficacy, HbA1c, fasting blood glucose, and cholesterol level of patients diagnosed with type 2 diabetes who visit the hospital as outpatients affect their self-care.

The average self-care score in this study was 68.7 out of 100, which is slightly higher than median. About 77.1% of participants did not have experience of hospitalization, which led them to believe that their self-care skills were better than average. However, 50.8% of the participants had complications, and the average duration of disease experience was 10.9 years. Further, only 19.5% of the participants were controlling their HbA1c to below the level recommended by the Korean Diabetes Association, which showed a poor self-care status among the participants. One of the main causes of death among patients with type 2 diabetes is arteriosclerotic cardiovascular diseases, for which obesity is the most well-known risk factor. The average BMI in this study was 25.8(kg/m^2), and 73.7% of participants were overweight. Since diabetes is a chronic disease, it entails higher chances of developing complications with an increasing duration of the experience of the disease if proper self-care is not performed. Therefore, intensive lifestyle care programs should be developed, and patients should be encouraged to participate to help them become aware of their condition and consistently engage in self-care activities.

Among the subcategories, participants scored the lowest in the management domains of changing diet, exercise, and insulin injection adjusted for controlling blood glucose levels when they become aware of their symptoms associated with an abnormal blood glucose level. This corresponds to the findings of a study by Ausili *et al*. [17], reporting that diabetic patients did not respond effectively to the changes in their blood glucose levels or symptoms. In this study, 83.1% of the participants had 1 or more comorbid conditions, while 50.8% had complications. Comorbid conditions and complications were found to be barriers that interrupted self-care among patients with diabetes [18], and it was discovered that pain experienced by diabetic patients from comorbid conditions or complications also affected HbA1c [19]. Complex medication schedules in the event of comorbid conditions, as well as other factors related to finance, time, and debilitation caused patients

to feel burdened [20] [21]. These factors were the highest constraints on self-care activities by patients. The quality of life was low, the amount of physical activity was reduced, and the execution of self-care was poor when diabetic patients had comorbid conditions [22]. Therefore, individualized self-care education that takes into consideration the comorbidities and complications of each patient should be offered for patients to improve their symptoms and reduce the severity of their complications.

As the self-efficacy score of the participants increased and HbA1c and fasting blood glucose decreased, their self-care score increased. This result corresponds to the findings of a study by D'Souza *et al*. [23], reporting that higher self-efficacy resulted in lower HbA1c, which is a physiological index of self-care. This is also in line with the findings of a study by Saad *et al*. [24], which reported that higher self-efficacy led to better self-care. As diabetic patients become more conscious of the disease as time passes after the first diagnosis, they gain more knowledge and their self-efficacy increases because they start to believe that the disease can be controlled. However, the actual implementation of self-care behavior is not very high, because they lack accurate knowledge about how to control blood glucose levels [25]. Diabetic patients must constantly control these levels and manage complications throughout their life, as diabetes is a chronic disease that cannot be cured. Thus, various programs must be developed through which personalized knowledge of diet, exercise, and medication can be provided for self-care among diabetic patients, such that their self-efficacy continues to increase based on positive feedback on blood glucose goals and symptoms rather than unsupported confidence.

The four primary factors that affected self-care of the participants in this study were self-efficacy, HbA1c, employment, and smoking, which together had a high explanatory power of 69%. The self-care score of diabetic patients was higher when the participants had higher self-efficacy, lower HbA1c, were not employed and did not smoke. The predictor that had the greatest impact on self-care in this study was self-efficacy, which corresponds to the findings of studies by Saad *et al*. [24] and Gao *et al*. [26] indicating that higher self-efficacy led to better self-care performance and lower HbA1c.

The self-efficacy of participants in this study was relatively high; however, the level of self-care was only intermediate. The number of patients with controlled blood glucose level was low compared to the rate of performance of self-care. To treat diabetes, patients are first instructed to change lifestyle habits, such as by adopting healthier diet and exercise. Subsequently, they are prescribed OHA, and then insulin therapy is introduced when blood glucose levels cannot be controlled, or complications occur. When diabetic patients begin insulin therapy, they think their condition has worsened because their diet and OHA have not been effective in managing the disease [27]. Therefore, they take the condition seriously and execute self-care tasks such as blood glucose monitoring better [28]. Since most of the participants in this study (83.9%) controlled their blood glucose level with OHA, while only 16.1% were given insulin therapy, it allowed them think their condition had not worsened and that their self-care skills, including diet control, were rather adequate, thus resulting in high self-efficacy. The number of participants with high prevalence of complications and adequately controlled HbA1c was also low; thus, further studies should be conducted in order to examine if controlling blood glucose is difficult when insulin therapy is delayed because patients refused to initiate such therapy [29].

In this study, participants who were not employed and did not smoke exhibited better self-care, which corresponded to the results of a study by Lee and Park [30], in which individuals who were not employed executed better self-care, and to a study by Jung *et al*. [31] reporting that individuals who smoked had lower self-care scores. According to an Organization for Economic Co-operation and Development (OECD) report [32], 75.9% of males in Korea are involved in economic activity, and the working hours are 1.3 times longer than the OECD average. Long working hours lead to a lack of exercise, which is a risk factor for type 2 diabetes and obesity [33]. To effectively manage diabetes, common risk factors such as obesity, drinking, smoking, and a lack of exercise must be managed [2]. Despite their interest in staying healthy, however, office workers spend most of their time sitting in the office, with excessive workloads, stress, frequent eating out and drinking, consumption of instant food products, and limited physical activity, and thus fail to adequately manage risk factors [34]. Therefore, further studies should be conducted to develop and verify the effects of a program that will help diabetic patients who work in offices to start and maintain self-care, such as by adopting healthy diet and exercise practices according to their situation. Considering the previous results [10] showing that self-care education was more effective when the participants' age and cultural characteristics were taken into account, gender, age, and employment status are crucial when developing self-care interventions for diabetic patients. Furthermore, four out of 10 male diabetic patients in Korea currently smoke to relieve stress [2]. These individuals are aware that smoking is a risk factor that could cause complications associated with micro-vessels of great arteries in diabetic patients, having learned it during initial education on diabetes. However, behavioral change for self-care nevertheless does not take place, even though quitting smoking would help prevent complications associated with cardio-cerebrovascular diseases. Continuing to smoke indicates that they do not have a high level of self-control [35], and lack of changes in lifestyle habits such as diet or exercise routines to control blood glucose levels also indicate that self-control is not properly managed, thus resulting in lower self-care. This phenomenological study on self-care among patients with type 2 diabetes showed that participants who had positive self-care experiences strengthened their self-control. They exhibited a willingness to continue with self-care, attempted to change to and adopt healthy lifestyle habits, actively participated in education on diabetes, and followed the instructions of healthcare providers well [36]. Based on such results, a self-care improvement program should be developed that can inspire patients, the agent of self-care, and boost their self-confidence in blood glucose control by setting realistic goals and enhancing positive self-control experience through achievements.

CONCLUSION

The results of this study showed that self-efficacy and HbA1c, which can be changed through interventions, were the most significant factors affecting self-care in patients with type 2 diabetes, rather than constant variables such as sociodemographic variables. In terms of diabetes care, various related factors should be examined in order to heighten self-care while enabling diabetic patients to perform self-care activities more effectively. To increase the level of self-care in patients with type 2 diabetes, primary influential factors that should be considered are self-efficacy, HbA1c, employment, and smoking. Furthermore, a program should be developed that will promote consistent self-care by increasing self-efficacy and synchronizing patients as the main agent of self-care through positive achievements as the main agent of self-care.

A limitation of this study is that data on the participants' self-care activities were collected through a self-report survey instead of actual observation. Hence, physiological indices such as HbA1c and fasting blood sugar were measured to complement the qualitative aspect of the data. The collected data were, however, extracted during a period of three months from the day that patients visited the hospital; there was, therefore, a lack of long-term follow-up data. Lastly, repeated studies are especially necessary, as the results cannot be generalized since the data were collected from outpatients of only one university hospital. Finally, unemployed status, which is a factor influencing self-care, may have different effects on overall psychological status and types of activities depending on whether the patient is retired or involuntarily unemployed. This should be considered in the future studies.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study obtained approval (IRB File No. CBNUH 2018-10-020) from the institutional review board of the Chungbuk National University Hospital, in Cheongju, Republic of Korea.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures were followed in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

Not applicable

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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