ORIGINAL RESEARCH

Factors Influencing the Severity of Diabetic Retinopathy in Patients with Type 2 Diabetes Mellitus in Korea

Yeong-Mi Jo[1], Yun-Jeong Boo[1]* & Susie Yoon[2]

[1]Cheju Hall University; [2]Youngsan University
***Corresponding Author:** Yun-Jeong Boo, Cheju Hall University, Jeju City, South Korea.
Email: booboo@chu.ac.kr
https://doi.org/10.47988/janany.786428687081.2.2

Abstract

Background: To prevent the progression of diabetic retinopathy (DR), patients with Type 2 diabetes mellitus (T2DM) should take the lead in their health behaviors by understanding physiological indicators such as blood sugar, blood pressure, lipids, smoking cessation, and regular ophthalmologic examinations. The health provider's role is important in motivating diabetic retinopathy patients to practice healthy behaviors since they provide treatment information and feedback to the patient. Therefore, it is necessary to educate diabetic patients on their knowledge of diabetic mellitus (DM) to raise awareness of desirable health behaviors and to continue self-management through motivation with the support from family and health care providers. This is a descriptive survey research to identify whether patients' knowledge about diabetes, family support, and health care provider's support for autonomy impacted the severity of diabetic retinopathy of patients with type 2 diabetes mellitus. **Objectives/Significance:** The aim of this study is to determine the effects of diabetic knowledge, family support, and health care provider's support for autonomy on the severity of diabetic retinopathy among diabetic patients and use this information as primary data for developing health behavior practice programs to prevent and manage diabetic retinopathy. **Methodology:** Cross-sectional data were collected in South Korea in 2019. Participants were 136 patients who had T2DM who attended an outpatient endocrinology clinic. A chi-square test and analysis of variance (ANOVA) were conducted using SPSS software (version 24.0), and Cronbach's coefficient was used to measure the reliability of each test. A linear multiple regression analysis was performed to determine the predictors of diabetic retinopathy. The scale for knowledge about diabetes had 26 items, the scale for family support had 12 items, and the scale for the severity of DR was classified according to the international clinical diabetic retinopathy severity measurement standards. **Results:** The comparisons of the severity of diabetic retinopathy depended on general and disease-related characteristics, and there was a statistically significant difference between DR and diabetic complications (t=4.07, $p<.001$). Significant correlations with SBP (r=.35 and p<.001), DBP (r=.37, $p<.001$), HbA1c (r=.29, $p=.001$), LDL- cholesterol (r=.18, $p=.036$), and triglyceride (r=.28, $p=.001$) were identified. Also, health care provider's support for autonomy was significantly correlated with the severity of DR (r=-.17, $p=.048$). As a result of analyzing the influence of independent variables on diabetic retinopathy, DBP (ß=.281, $p=.018$), DM complications (ß=.188, $p=.024$), and health care provider's support for autonomy (ß=- .207, $p=.002$) were found to affect the severity of diabetic retinopathy (F=5.725, $p=.018$). As a result of analyzing the influence of independent variables on diabetic retinopathy, DBP (ß=.281, $p=.018$), DM complications (ß=.188, $p=.024$), and healthcare provider's support for autonomy (ß=- .207, $p=.002$) were found to affect the severity of diabetic retinopathy (F=5.725, $p=.018$). The explanation power of this regression model was 29.6%, and it was statistically significant (F=5.725, $p=.018$).

Keywords: Diabetic Mellitus, Diabetic Retinopathy, Relational Autonomy, Professionals

Funding: This research did not receive any support, financially or in kind.

Conflict of Interest: The authors declare no actual or potential conflict of interest.

Acknowledgment: The research protocol was reviewed and approved by endocrinologists and nurses from the Department of Endocrinology and the Jeju University Hospital Ethics Review Committee.

Date Submitted: November 29, 2021 Date Accepted: March 19, 2022 Date Published Electronically – August 23, 2022

Factors Influencing the Severity of Diabetic Retinopathy in Patients with Type 2 Diabetes Mellitus in Korea

According to the Korean Diabetes Association, one in seven adults age 30 and older in Korea have diabetes mellitus (DM), accounting for 13.8% of the population (Jung et al., 2020). Diabetic retinopathy (DR) is one of the micro-complications of DM patients and is a major cause of vision loss and blindness in adults (Yau et al., 2012). The prevalence of DR among diabetic patients over the age of 30 in Korea is about 15.9% (Chung et al., 2020). Globally, the annual incidence rate of DR is 2.2%–12.7% and the annual progression rate is 3.4%–12.3% (Health Insurance Review & Assessment Service, 2012; Sabanayagam et al., 2019). In Korea, the prevalence of DR is increasing as the prevalence of diabetes increases due to Westernized dietary habits and lifestyle changes, and an aging population (Seong et al., 2021). The medical cost burden of this increasing trend is expected to consequently rise exponentially (Song et al., 2018).

The severity of DR, mild non-proliferative DR, moderate non-proliferative DR, severe non-proliferative DR, and proliferative DR can be divided into four stages. For severe proliferative DR, vision loss develops gradually or rapidly; regular examination and management are therefore critically needed (Ghaem et al., 2018; Gye & Song, 2015). Hyperglycemia and hypertension are risk factors for diabetes-related microvascular complications in DM patients (Ting et al., 2016; Wong et al., 2016; Zheng et al., 2018). In addition, as glycated hemoglobin (HbA1C) and blood pressure increase, the risk of DR increases. Hyperlipidemia was also reported as a risk factor of DR (Wong & Sabanayagam, 2019).

In order to prevent the progression of DR, it is important for patients to take the lead in their health behaviors by understanding physiological indicators such as blood sugar, blood pressure, and lipids, as well as adherence to medications, diet, exercise, smoking cessation, and regular ophthalmologic examinations (Chang & Shin, 2016; Ghaem et al., 2018; Pérez-Manchón et al., 2017). Previous studies on health behavior practice and self-management factors of DR showed that high DM knowledge score correlates with low HbA1c; better self-management implementation is supported by spouses and families (Chang & Shin, 2016).

Meanwhile, DR patients are recommended to undergo regular ophthalmologic examinations every 1 - 3 months. Importantly, it is difficult to recognize the progression of DR for patients in the early stages because it does not significantly affect their vision (Cheloni et al., 2019; Korean Diabetes Association, 2019). Thus, the role of the health care provider is essential in motivating DR patients to practice healthy behaviors since they provide treatment information and feedback to patients (Williams et al., 2018; Wong & Sabanayagam, 2019). Health care providers' focus on patient autonomy means support by health care providers so that patients can choose and make decisions on their own to control their behaviors (Seo & Choi, 2011). Previous studies of Type 2 diabetes mellitus (T2DM) patients showed that support for self-management has a major positive effect on patient's self-management (Moon & Lee, 2014; Tahmasebi, 2015). Furthermore, a supportive family means that T2DM patients receive more appreciation and understanding that encourage better diet control and exercise performance. It was found that self-care performance and blood sugar control were high in a T2DM patient group with high family support (Kim & Gu, 2016; Park et al., 2009).

It is therefore necessary to educate diabetic patients about DR in order to raise awareness of desirable health behaviors and for them to sustain self-management behaviors by way of family and health care providers' support (Kim & Jang, 2018; Lian et al., 2018). However, there has been insufficient research relating physiological indicators such as blood sugar, blood pressure, and lipids to such factors as DM knowledge, family support, and health care provider's focus on patients' autonomy and self-management, with regards to their effects on the occurrence of DR among DM patients. It was, therefore, the aim of this study to determine the effects of DM knowledge, family support, and health care providers' support for autonomy on the severity of DR in T2DM patients and to use the results as primary data for developing health behavior practice programs to prevent and manage DR.

Methods

Design

A non-experimental quantitative research approach with a cross-sectional predictive design was employed to determine the link between predictor variables and the progression of DR in T2DM patients in South Korea.

Participants and Setting

The sample for this study was composed of T2DM endocrinology patients in the outpatient clinics of Jeju University Hospital in Korea. Inclusion criteria were (1) patients over the age of 20 diagnosed with T2DM, (2) patients diagnosed with DR, (3) patients able to communicate in Korean, (4) patients without hearing or reading impairment, and (4) patients who would voluntarily participate in surveys. The exclusion criteria were patients with adrenal insufficiency or hypothyroidism that might cause hypoglycemia. A power analysis using G*power 3.1.9.2. indicated the desired sample size to be 89, based on the parameters for linear multiple regressions (Effect size f2 = .15; Power (1-ß) = .95; significance level (α) = .05; two-tailed). One hundred and thirty-six (136) qualified patients provided informed consent and were enrolled as participants in this study.

Variables and Measures

The general demographic questionnaires included gender, age, marital status, education, background, job, and smoking status. The DM complications, HbA1C, LDL-cholesterol, HDL-cholesterol, and triglycerides were collected from the last medical records within the previous six months. Blood pressure (BP) was measured twice with a sphygmomanometer (OMRON, China), and the mean value was recorded, once after filling out a written consent form and once after completing the questionnaire. The

severity of DR was determined by the International Clinical Diabetic Retinopathy Disease Severity scale criteria: (1) no diabetic retinopathy, (2) mild non-proliferative diabetic retinopathy (mild NPDR), (3) moderate NPDR, (4) severe NPDR, (5) proliferative DR (PDR; Wilkinson et al., 2003). If the severity of DR in both eyes was different, the severity of the more severe eye was adopted. The severity of DR is scored from 1 point for no findings to 5 points for PDR, which means that the higher the score is, the more severe the DR is. The DM Knowledge level was measured using the design by Sim et al. (2006). It consists of a total of 26 questions: general knowledge about diabetes (6 questions), treatment goals (1 question), diet (3 questions), hypoglycemia (3 questions), and complications (7 questions). A higher score indicates higher diabetes knowledge. Cronbach's α in Sim et al. (2006) was .84, and Cronbach's α in this study was .78. Family support was measured using the design by Gu (1999). It consists of a total of 12 questions with a 4-point Likert scale. A higher score indicates higher family support. Cronbach's α in Gu (1999) was .85, and Cronbach's α in this study was .87. The health care providers' support for autonomy was measured by using the Health Care Climate Questionnaire (HCCG) in Williams et al. (1996), that was translated to Korean by Seo and Choi (2011). It consists of a total of 15 questions using a 7-point scale. A higher score indicates higher health care providers' support for autonomy. Cronbach's α in Williams et al. (2009) was .89, Cronbach's α in Seo and Choi (2011) was .84, and Cronbach's α in this study was .94.

Data Collection and Ethical Considerations

The study method and protocol were reviewed and approved by endocrinologists and nurses from the Department of Endocrinology and the Jeju University Hospital Ethics Review Committee (IRB No. JNUH 2019-03-012); the data were collected from June 17 to August 27, 2019. After explaining the study's progress to the patients during outpatient visits, a written, signed consent was obtained once they agreed to participate in the study. Participants completed a survey using a structured questionnaire. The research assistant explained the purpose and procedures of the research and the data collection method, as well as obtained participants' signatures on the consent form. The form included information about the right to withdraw participation at any point during the survey, and the assurance of the anonymity and confidentiality of the participants. The research assistant read the items verbatim without further explanation and filled out the questionnaires with the participants' responses if they requested assistance, such as in the case of patients with poor eyesight or those who had difficulty conveying meaning on paper. Participation in this research was voluntary, and all participants were required to complete the self-report questionnaire. The average time taken to complete the questionnaire was 20-30 minutes. Participants also consented for their medical records to be examined for blood test results, using those done within the last six months. All participants were informed of the preservation of their anonymity and the maintenance of confidentiality throughout the study. Additionally, completed questionnaires were kept in a locked cabinet to maintain the privacy of participants. Participation was completely voluntary, and patients were assured that their responses would be kept confidential, with research results reported in aggregated format.

Statistical Analysis

A statistician confirmed the sample size calculation, statistical tests, and the analysis of the characteristics of the experimental data. Among the 140 structured questionnaires distributed, four were ultimately not included in the analysis owing to incomplete or missing data (response rate was 97.1%). In total, 136 patients were included in this study. The data from this study were analyzed using SPSS software (version 24.0). First, the frequencies and percentages were calculated for the general characteristics and disease-related characteristics of the participants. Means and standard deviations were analyzed using descriptive statistics for knowledge of DM, family support, health care provider's support for autonomy, and severity of DR. The differences in severity of DR according to the participants' characteristics (gender, age, spouse, education background, job status, smoking, DM complications, and experience with DM education) were analyzed using an independent t-test and one-way ANOVA test. Scheffé's test was performed as a post hoc test. The correlations between the participants' BP (Systolic BP, Diastolic BP), blood tests (HbA1c, LDL-cholesterol, triglyceride), DM knowledge, family support, and health care provider's support for autonomy were analyzed using Pearson's correlation coefficient. A linear multiple regression analysis was conducted and used for the analysis to confirm the effects of DR, diastolic blood pressure, DM complications, and health care provider's support for autonomy on the severity of DR, as well as variables that were significant according to subject characteristics, DM knowledge, and support from family and health care provider's support for autonomy.

Results

As for the participants' general characteristics, 95 (69.9%) were male, and the mean age was 62.04 years. The majority of the participants had a spouse (75.7%), were high school graduates (44.1%), had a job (51.5%), had quit smoking (77.2%), had non-DM complications (62.5%), and did not have experience with diabetes education (66.2%). In terms of disease-related characteristics of the participants, mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 132.87 and 79.79 mmHg, HbA1c was 8.24%, LDL-cholesterol was 114.94 mg/dL, and triglyceride was 186.4 mg/dL.

Table 1

General and Disease-Related Characteristics of Participants (N=136)

Variables	Categories	N (%)	M±SD
Gender	Male	95(69.9)	
	Female	41(30.1)	-
Age (years)	< 50	19(14.0)	
	50-59	33(24.3)	
	60-69	37(27.2)	62.04±11.31
	≥ 70	47(34.5)	
Spouse	Yes	103(75.7	-
	No	10(7.4)	
Education	< High school	33(24.3)	
	High school graduate	60(44.1)	
	> High school	43(31.6)	-
Job status	Yes	70(51.5)	
	No	65(47.8)	-
Smoking	Yes	31(22.8)	
	No	105(77.2)	-
DM Complications	Yes	51(37.5)	
	No	85(62.5)	-
Experience of diabetes education	Yes	46(33.8)	
	No	90(66.2)	-
Blood pressure (mmHg)	Systolic blood pressure		132.87±19.43
	Diastolic blood pressure		79.79±11.38
Blood test	HbA1c (%)		8.24± 1.31
	LDL-cholesterol (mg/dL)		114.94± 62.4
	Triglyceride (mg/dL)		186.4±98.85

Note. M±SD=Mean ± standard deviations; DM=Diabetes Mellitus; LDL=Low-Density Lipoprotein; HbA1c=Hemoglobin glycosylated hemoglobin.

Participants' DM knowledge was 11.45±3.71, family support was 39.30±7.33, and health care provider's support for autonomy was 81.01±12.93; the mean severity of the DR was 3.35±1.21.

There was a statistically significant difference between the severity of DR and DM complications (t=4.07, p<.001).

Table 2

Participants' DM Knowledge, Family Support, Health Care Provider's Support For Autonomy, and Severity of DR (N=136)

Categories	M	SD	Range
DM knowledge	11.45	3.71	2 -19
Family support	39.30	7.33	15 - 48
Health care provider's support for autonomy	81.01	12.93	42 - 105
Severity of DR	3.35	1.21	2 - 5

Note. There was a statistically significant difference between the severity of DR and DM complications (t=4.07, p<.001).

Table 3

Comparisons of the Severity of DR According to General and Disease-Related Characteristics of Participants (N=136)

Variables	Categories	M±SD	t/F	*p*
Gender	Male	3.41±1.250	.950	.344
	Female	3.20±1.122		
Age (years)	< 50	3.90±1.17	1.727	.164
	50-59	3.21±1.22		
	60-69	3.32±1.20		
	≥ 70	3.35±1.21		
Spouse	Yes	3.44±1.22	-1.559	.121
	No	3.06±1.17		
Education	< High school	3.30±1.24	2.576	.080
	High school graduate	3.13±1.10		
	> High school	3.68±1.30		
Job status	Yes	3.39±1.26	.371	.711
	No	3.31±1.18		
Smoking				
	Yes	3.45±1.21	.731	.582
	No	3.31±1.22		
DM Complications				
	Yes	3.86±1.17	4.066	<.001**
	No	3.04±1.14		
Experience of diabetes education	Yes	3.11±1.23	-1.638	.104
	No	3.47±1.19		

*Note. M±SD =Mean ± Standard deviations. *p<.05. **p<.01.*

The Scheffé post-hoc test revealed that there were no statistically significant differences in severity of DR according to general and disease-related characteristics of participants.

As a result of analyzing the correlation between the participants' disease-related characteristics (SBP, DBP, blood test), DM knowledge, family support, and health care provider's support for autonomy, and severity of DR, significant correlations with SBP (r=.35, p<.001), DBP (r=.37, p<.001), HbA1c (r=.29, p=.001), LDL-cholesterol (r=.18, p=.036), and triglyceride (r=.28, p=.001) were found. Therefore, the higher the SBP and DBP were, the greater the severity of DR. Also, the health care provider's support for autonomy was significantly correlated with the severity of DR (r=-.17, p=.048). On the other hand, DM knowledge and family support were found to have no significant correlation with the severity of DR.

Table 4

Correlations Between Blood Pressure, Blood Test Support, DM Knowledge, Family Support, Health Care Provider's Support for Autonomy, and Severity of DR of Participants (N=136)

Variables	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_2	1	.						
X_3	.74**	1						
X_4	.24**	.21*	1					
X_5	.27**	.14	.20*	1				
X_6	.15	.06	.14	-.02	1			
X_7	.01	.03	-.06	-.03	-.02	1		
X_8	.03	.06	.12	-.06	.01	.23**	1	
X_9	.35**	.37**	.29***	.21*	.15	-.02	-.17*	1

Note. X_2= Systolic blood pressure, X_3= Diastolic blood pressure, X_4= HbA1c (%), X_5=Triglyceride (mg/dL), X_6= DM knowledge, X_7=Family support, X_8=Health care provider's support for autonomy, X_9=severity of DR of Participants

**p<.05, **p<.01, ***p<.001*

A multiple regression analysis was performed to identify the influencing factors affecting the progression of DR. DM complications, physiological variables (DBP, HbA1c), DM knowledge, family support, and health care provider's support for autonomy were used as independent variables. As a result of examining the multicollinearity among independent variables, it was found that the tolerance limit was more significant than the general standard of 0.1, and the variance expansion factor (VIF) was smaller than 10. This means that the multicollinearity was satisfied (tolerance limit 0.833-0.983, VIF 1.017-1.072). The analysis of the influence of independent variables on DR proved to influence its severity – DBP (ß=.281, p=.018), DM complications (ß=.188, p=.024), and health care provider's support for autonomy (ß=- .207, p=.002). The results showed that the regression equations account for 29.6% of the total variation. The F value was 5.725 (p=0.018), which was statistically significant in the regression model.

Table 5

Factors Affecting the Severity of DR (N=136)

Variables	B†	SE	ß‡	t	p	Tolerance limit	VIF
Diastolic blood pressure	0.030	0.008	0.281	3.758	0.018	.933	1.072
DM Complications[a]	0.002	0.001	0.188	2.547	0.024	.960	1.041
Health care provider's support for autonomy	-0.019	0.007	-0.207	-2.843	0.002	.983	1.017
Adj R^2=.296(F=5.725, p=.018) Durbin-Watson=1.751							

Note. a 0=No, 1=Yes.

† unstandardized regression coefficients

‡ standardized regression coefficients

DM=Diabetes Mellitus; HbA1c=Hemoglobin A1c (glycosylated hemoglobin); VIF=the variance expansion factor

Discussion

In order to prevent progression to severe retinopathy for T2DM, priority should be placed on identifying physiological indicators affecting DR, including those variables affecting self-management practice and maintenance identified as significant factors in previous studies. Therefore, this study investigated the effects of general characteristics, such as gender and age of outpatient T2DM and disease-related characteristics including physiological indicators, e.g., HbA1C and LDL-cholesterol, as well as DM knowledge, family support, and health care provider's support for autonomy on DR.

The results showed that from the overall multiple linear regression, including DM complications and physiological indicators (SBP, DPB, HbA1c, LDL, TG), DM knowledge, family, and health care provider's support for autonomy were statistically significant.

From the results of this study, it was determined that the progression of DR is relatively severe in patients who have DM complications compared to those with none. In addition, HbA1c was not identified as a significant variable affecting the severity of DR, but was found to have a significant correlation with the severity of DR statistically. High blood sugar is thought to have worsened the degree of retinopathy because it was not continuously controlled until DM complications occurred. Moreover, patients did not recognize retinopathy and were not diagnosed with it at an early stage since early DR does not significantly affect their eyesight. Matuszewski et al. (2020) found that hyperglycemia is a major risk factor and a modifiable factor for DR, regardless of diabetes type. Kumari et al. (2019) reported that patients with poor blood sugar control have a quadrupled risk of developing DR. Therefore, it is necessary to emphasize blood glucose control and education about complications among T2DM patients, including that of DR. Also, it is important to diagnose and manage DR at an early stage by identifying and managing patients who do not maintain blood glucose control as a risk group.

As the DBP of DR patients increased, the severity of DR decreased, and SBP also showed a significant correlation, indicating that BP control was a significant factor in controlling

the progression of DR severity. Several previous studies have shown that hypertension was associated with the risk of blood sugar control and DR, and studies using the Prospective Diabetes Study (UKPDS) trial and antihypertensive drugs reported that strict control of blood pressure reduces the occurrence and progression of DR (Raman et al., 2017; Song et al., 2016; Stratton et al., 2001; Wong & Sabanayagam, 2019). The Committee of Clinical Practice Guidelines of the Korean Diabetes Association set blood pressure control targets for diabetic patients at SBP of less than 140 mmHg and DBP of 85 mmHg and recommended that hypertension medication be initiated if blood pressure was not controlled through therapeutic lifestyle adjustments (Kim et al., 2019). High blood pressure damages the micro-vessels in the retina and worsens DR severity. Hence, patients should make continuous efforts to maintain a healthy lifestyle, including smoking cessation, limited alcohol consumption, regular exercise for targeted blood pressure management, and use of medications (when necessary) in order to delay the progression to DR (Chan & Shin, 2016).

This study identified healthcare provider's support for autonomy as a predictor of the severity of DR; as healthcare provider's support for autonomy increased, the less likely that the severity of DR worsened. Results of previous studies reiterated health care providers' support for DR patients' autonomy, e.g., offering information about regular ophthalmologic examinations and feedback on positive health behavior practices (Park et al., 2016; Williams et al., 2018). A cooperative relationship between health care providers and patients have shown a favorable effect on treatments and health behavior practices of patients with chronic diseases, and health care provider's support for autonomy motivated patients to continue with self-management (Lee et al., 2018; Lee et al., 2019; Wong & Sabanayagam, 2019). Weiss et al. (2015) emphasized the importance of early intervention in preventing DR among this high-risk population. Health care providers should provide frequent feedback using various strategies, whether face-to-face or otherwise, in order to facilitate self-management among DR patients. Providers should likewise recommend periodic outpatient visits, checkups, behavior modifications, and maintain positive relationships with their patients. Frei (2014) suggested that health care providers utilize a monitoring tool or semi-structured protocol that includes health behavior metrics, such as clinical parameters (e.g., HbA1C, BP, cholesterol level), evidence of dietary control, compliance with ophthalmologic examinations, medication adherence, etc. These provide opportunities for health care providers and patients to establish specific behavioral goals, develop self-monitoring skills and for patients to adopt healthy behaviors based on data obtained from the monitoring tool or clinical protocol (Frei, 2014). Health care providers can also pick up cues from the monitoring tool or clinical protocol that confirm positive behavioral changes to support patients' adherence to action plans in order to achieve desired outcomes (Pizzi, 2015; Simon, 2010).

Consistent with the results of this present study, Chang and Shin (2016) reported that diabetes knowledge did not have a significant effect on DR severity. However, the Korean Diabetes Association identified diabetes self-management education (DSME) as a standard of medical care for people with diabetes (Hur et al., 2021). Umeukeje et al. (2020) reported that the attitudes of health care providers and their support of patients' autonomy had been linked to more effective counseling and patient education. Education and counseling for health management are pivotal nursing roles in patients' health recovery. Nurses are responsible for providing patients with sufficient information in order for them to make independent and informed decisions with regards to their own goals and values. Previous research also supported this, especially among diabetic patients (Williams et al., 1996). The support for autonomy and empowerment afforded by healthcare providers facilitate desirable physiological outcomes among T2DM patients with DR.

This study also showed that diabetes education experience did not have any influence on the severity of DR. In addition, it was challenging to compare family support, health care provider's support for autonomy, and DM knowledge to identify factors affecting the severity of DR. In the case of family support, the majority of the participants were 50-70 years old (51.5%) and had no diabetes education experience (66.2%). It is likely that most of the participants shared and obtained information related to diabetes management from their work or social community. Wong and Sabanayagam (2019) emphasized that improving self-care behaviors was necessary to manage blood sugar, and that patients need the knowledge to understand the severity of their condition at the time of DR diagnosis to facilitate the improvement of their health behavior. Beaser et al. (2018) conducted patient-centered DR prevention and management education programs for DM patients, and their research outcomes showed that patients' awareness of their healthcare condition and their motivation for self-care behavior increased after attending these educational programs.

It is necessary to educate patients more actively on blood sugar control and the importance of regular ophthalmologic examination during outpatient visits and provide nursing interventions for BP control. Educational materials and programs must be developed to prevent and manage DR. These must be in various means and formats so that patients can readily access them.

Study Limitations

This study focused on DR patients at a regional hospital and its results may not be generalizable to the larger population. It should be repeated using more rigorous sampling and research design.

Conclusion

Diabetic complications, DBP, and health care providers' support for autonomy were identified as factors affecting the severity of DR. Interventions to improve self-care behavior in managing T2DM, awareness of hypertension and DR complications, and the provision of DR screening services must receive more heightened focus among healthcare providers. Healthcare provider's support for patient's autonomy for self-management was found to be the most significant predictor of the severity of DR. The role of healthcare providers is quite relevant in forging a stronger professional relationship with patients. More novel and practical strategies must be thought of in order to have a more engaging provider-patient relationship that will enhance the achievement of favorable outcomes for these patients.

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