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Original Article

Health-Related Quality of Life among Elderly Individuals with Both Diabetes and Disabilities in Korea: Results from a Nationally Representative Survey

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SUMMARY

Background: Disability is an important factor to consider when providing care aimed at improving health-related quality of life (HRQoL) in elderly individuals with diabetes. However, few studies have explored the influence of disability on HRQoL in this group. This study aimed to compare HRQoL among elderly individuals with and without disabilities who were diagnosed with diabetes, and to identify factors related to HRQoL.

Method: A sample of 927 participants with diabetes aged from 65 to 98 was obtained from the Korean Health Panel in 2017 (195 were disabled). Differences in HRQoL were assessed among independent samples between participants with disabilities and those without disabilities using *t*-tests and Chi-square tests. Hierarchical multiple regression analysis determined factors related to HRQoL among participants with disabilities.

Results: All dimensions of HRQoL in participants with disabilities were significantly poorer than in those without disabilities. Lower levels of instrumental activities of daily living (β = -0.509, $p < 0.001$), hypertension (β = -0.152, $p = 0.008$), arthritis (β = -0.133, $p = 0.019$), high stress (β = -0.193, $p < 0.001$), and higher levels of physical activity (β = 0.156, $p = 0.006$) were significantly associated with HRQoL in elderly participants with both diabetes and disabilities.

Conclusion: Elderly individuals with diabetes and disabilities are more likely to have poorer HRQoL than those without disabilities. The results demonstrate HRQoL are associated with lower levels of instrumental activities of daily living, hypertension, arthritis, high stress, and higher levels of physical activity.

1. Introduction

Disability is one of the important factors to consider when providing care for elderly individuals with diabetes, such as glucose control, hypoglycemic risk, and nutrition.[1] In Korea, 23.1% of elderly individuals with disabilities have diabetes.[2] Moreover, individuals with disabilities have a greater health burden than those without disabilities.[2] Accordingly, elderly individuals with both diabetes and disabilities are more vulnerable to problems with self-management of diabetes compared to those without disabilities. This suggests that individuals with both diabetes and disabilities should be provided with tailored interventions for managing diabetes.[1,3] However, there is little research available regarding interventions for those with both conditions.

Improving health-related quality of life (HRQoL) is a major goal of diabetes care for elderly patients.[4,5] Their HRQoL is poorer than that of elderly individuals without diabetes because they have the constant burden of poor glycemic control.[6,7] Moreover, disability negatively affects their HRQoL.[8] Thus, the HRQoL of elderly individuals with diabetes and disabilities may be lower than that of those without disabilities.

To develop interventions for elderly individuals with diabetes and disabilities, their HRQoL must be understood. Previous studies analyzing HRQoL among elderly individuals with diabetes were conducted without identifying whether participants also had disabilities.[9–11] Further, few studies examining the HRQoL of elderly individuals with both diabetes and disabilities have been reported. For those reasons, this study aimed to compare HRQoL between elderly individuals with diabetes and disabilities and those without disabilities, and to identify factors related to HRQoL.

2. Materials and methods

2.1. Design

This study was a secondary data analysis of data derived from the Korean Health Panel (KHP) study. The study was approved by the Institutional Review Board of Seoul National University (no. E1905/003-010), and written informed consent, which included information on confidentiality, was obtained from participants.

2.2. Sample

Data from the 2008–2017 KHP β-version 1.6 were used to address the study's objectives.[12] The KHP aimed to provide the basis

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for identifying changes in healthcare expenditures and establish the foundation for planning and improving healthcare policies in South Korea. In 2017, a sample of participants was obtained by selecting sample districts and choosing sample households in enumeration districts, using probability proportionate to size sampling methods. Computer-assisted personal interviews by trained staff were conducted to collect the KHP data.

All participants consented to the use of their data for research to analyze health status and healthcare expenditure. To analyze the HRQoL of elderly individuals with or without disabilities who had also been diagnosed with diabetes, the data of 927 participants in the 2017 dataset were used. All participants were over the age of 65 years and diagnosed with diabetes.

Disabled participants were those who had been diagnosed with disabilities by medical specialists according to the Korean Disability Act. In this study, disability is defined as a severe impairment of body function or structure, and classified into eye, ear, brain, heart, lung, kidney, or musculoskeletal system impairments.[13]

The sample size and *post-hoc* statistical power were computed using G*Power v 3.1.9.7 software. At least 189 elderly individuals with both diabetes and disabilities were needed based on effect size = 0.11, significance level of alpha = 0.05, power of 1-β = 0.80, and number of factors = 16. The effect size was calculated based on the results from a previous study.[15] The *post-hoc* power of this study was confirmed to be 0.81, which was adequate for analysis.

2.3. Variables

2.3.1. Independent variables

The independent variables included gender, age, marital status, educational attainment, employment status, body mass index (BMI), duration of diabetes, instrumental activities of daily living (IADL), activities of daily living (ADL), comorbidity, stress, and physical activity.

BMI (kg/m^2) was classified into two categories: normal weight (< 25) and overweight/obesity ($\geq$ 25). Duration of diabetes was classified in two categories: < 10 years and $\geq$ 10 years. To assess participants' activity limitations, IADL were measured using eight items rated on a four-point scale ranging from 1 ("I don't need any help") to 4 ("always"). Similarly, ADL were measured using seven items. For both measures, the scores were summed, resulting in ranges of eight through 32 (IADL) and seven through 28 (ADL). Higher scores indicated greater IADL or ADL dependency. In this study, Cronbach's alpha reliability coefficients for the IADL and ADL constructs were 0.85 and 0.84, respectively.

Stress was measured using the Brief Encounter Psychosocial Instrument-Korea.[15] Five items measured on a five-point scale assessed the experiences of physical and mental difficulty, frustration, unmet needs, uncertainty regarding the future, and forgetting important things. Based on average scores, two groups were identified as slightly stressed (< 1.8) and moderately/highly stressed ($\geq$ 1.8). Cronbach's alpha in this study was 0.80.

Comorbidity was assessed by the presence of hypertension, hyperlipidemia, arthritis, ischemic heart disease, and cerebrovascular disease. Physical activity was measured using the Korean version of the International Physical Activity Questionnaire.[16] To assess vigorous and moderate physical activities and walking, the number of days per week in which activities were performed for over 10 minutes per day and the total time of each activity were assessed. Based on the scores, metabolic equivalent task (MET) was calculated in minutes. Participants were divided into two groups: low group and moderate/high group. The moderate/high group was higher than 600 MET-min.

2.3.2. Dependent variables

HRQoL was assessed using responses to the EuroQol-5 dimensions-3 level instrument (EQ-5D-3L).[7] The measure has five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Responses are rated on a three-point scale ranging from 1 ("no problems") to 3 ("extreme problems"), and responses used in this study were scored using the South Korean value set.[17] Higher EQ-5D values indicate higher HRQoL. Cronbach's alpha in this study was 0.72.

2.4. Statistical analysis

Data were analyzed using SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). All variables were analyzed using descriptive statistics, independent sample *t*-tests, and Chi-square for contingency tests. Chi-square was used to compare dimensions of HRQoL between participants with disabilities and those without disabilities. A three-model hierarchical multiple regression analysis was conducted to explore the associations of HRQoL with independent variables among elderly individuals with both diabetes and disabilities. Based on the theory of HRQoL,[18] the effects of demographic and health-related characteristics were estimated in the first model. Stress was included as a psychosocial factor in the second model. In the third model, physical activity was added as a health-promoting behavior.

3. Results

3.1.Variables by disability

Table 1 presents the descriptive statistics of the variables for participants with or without disabilities. All participants had a diagnosis of type 2 diabetes, and 21.0% (n = 195) had disabilities. The gender distribution differed significantly by disability. A higher proportion of women had disabilities than men. Average age did not differ significantly between groups. Participants with disabilities were significantly more likely to be married. Level of educational attainment was significantly higher among participants without disabilities than among those with disabilities. Participants with disabilities were significantly less likely to be employed.

Participants with disabilities were significantly more likely to have been diagnosed with diabetes for over 10 years (p < 0.001). Significantly higher dependencies for IADL (p < 0.001) and ADL (p < 0.001) were observed among participants with disabilities. Participants with disabilities were also more likely to be in the moderately and highly stressed group (p = 0.014). A significantly higher prevalence of arthritis (p < 0.001) and cerebrovascular disease (p < 0.001) was found in participants with disabilities. Moreover, lower physical activity levels (p < 0.001) were found in participants with disabilities.

Participants with disabilities had significantly lower HRQoL levels (p < 0.001). The respective percentages of participants with disabilities and of those without disabilities who had problems in each dimension of HRQoL are shown in Figure 1. Overall, participants with disabilities had problems in all dimensions: 63.1% of participants with disabilities had problems with mobility (x^2 = 169.13, p < 0.001), 23.1% with self-care (x^2 = 80.80, p < 0.001), 43.1% with usual activity (x^2 = 121.56, p < 0.001), 81.0% with pain/discomfort (x^2 = 83.38, p < 0.001), and 29.2% with anxiety/depression (x^2 = 34.60, p < 0.001).

Table 1
Variables by disability.

Characteristics	Categories	Without disabilities *n* = 732 (79.0%)	With disabilities *n* = 195 (21.0%)	*p*
		Values		
Gender[a]	Male	352 (48.1)	67 (34.4)	< 0.001
	Female	380 (51.9)	128 (65.6)	
Age[b]		75.55 (±7.23)	76.37 (±7.30)	0.157
Marital status[a]	Spouse	194 (26.5)	92 (47.2)	< 0.001
	No spouse	538 (73.5)	103 (52.8)	
Education attainment[a]	≤ Middle school	478 (65.3)	152 (77.9)	0.003
	High school	171 (23.4)	31 (15.9)	
	≥ University	83 (11.3)	12 (6.2)	
Employment status[a]	Yes	312 (42.6)	42 (21.5)	< 0.001
	No	420 (57.4)	153 (78.5)	
BMI[a]	Normal weight	473 (64.6)	122 (62.6)	0.595
	Overweight and obesity	259 (35.4)	73 (37.4)	
Duration of diabetes[a]	< 10 years	432 (59.0)	85 (43.6)	< 0.001
	≥ 10 years	300 (41.0)	110 (56.4)	
IADL[b]		8.94 (±1.91)	11.31 (±3.88)	< 0.001
ADL[b]		7.09 (±0.60)	7.71 (±1.73)	< 0.001
Comorbiditiy[a]	Hypertension	528 (72.1)	151 (77.4)	0.080
	Hyperlipidemia	399 (54.5)	118 (60.5)	0.078
	Arthritis	368 (50.3)	130 (66.7)	< 0.001
	Ischemic heart disease	101 (13.8)	34 (17.4)	0.123
	Cerebrovascular disease	72 (9.8)	38 (19.5)	< 0.001
Stress[a]	Slightly stressed	618 (84.4)	150 (76.9)	0.014
	Moderately/highly stressed	114 (15.6)	45 (23.1)	
Physical activity[a]	Low	355 (48.5)	127 (65.1)	< 0.001
	Moderate/high	377 (51.5)	68 (34.9)	
HRQoL[b]		0.93 (±0.08)	0.81 (±0.10)	< 0.001

Note. ADL, activities of daily living; BMI, body mass index; HRQoL, health-related quality of life; IADL, instrumental activities of daily living.
[a] N (%). [b]Mean ± SD.

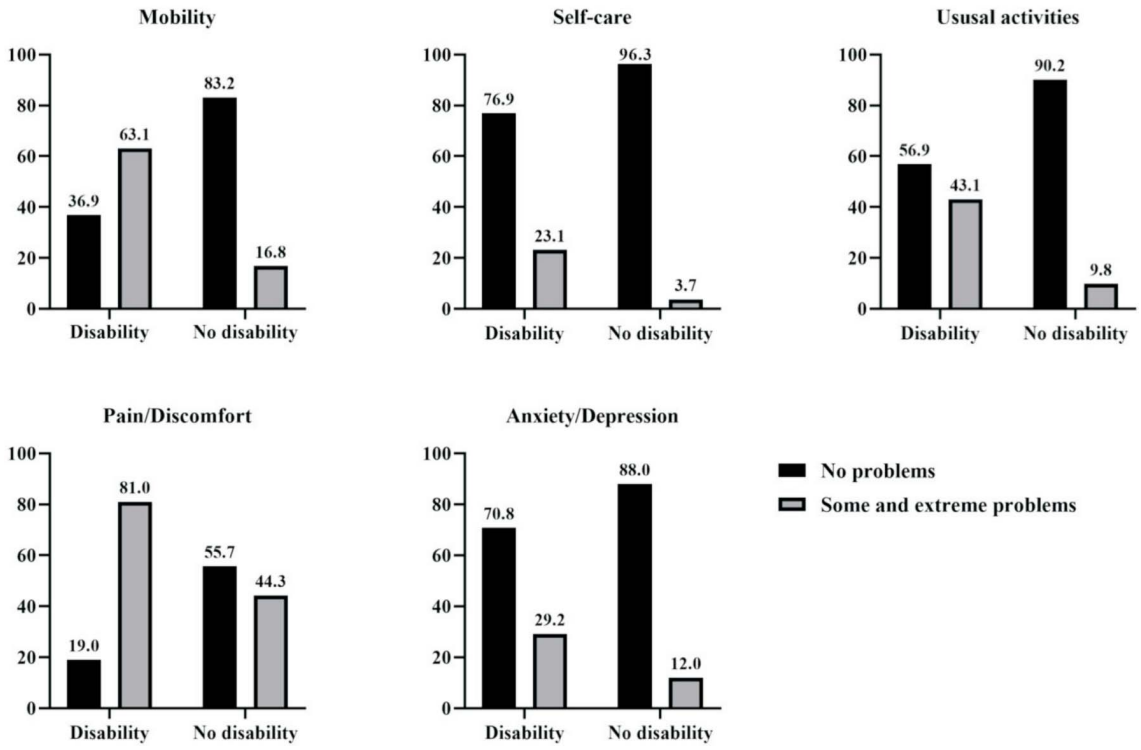

Figure 1. Distribution of dimensions in EQ-5D by disability.

3.2. Factors related to HRQoL among elderly individuals with both diabetes and disabilities

Table 2 presents the results of multiple regression analysis examining the associations HRQoL and independent variables in elderly individuals with both diabetes and disabilities. Using Model 1, we found that IADL, hypertension, and arthritis were significantly associated with HRQoL. Using Model 2, moderate/high stress was

Table 2
Hierarchical multiple regression analysis for HRQoL among elderly individuals with both diabetes and disabilities (n = 195).

Variables	Model 1		Model 2		Model 3	
	β	*p*	β	*p*	β	*p*
Gender (reference = men)	-0.041	0.541	-0.031	0.640	-0.024	0.702
Age	0.069	0.187	0.064	0.203	0.068	0.168
Marital status (reference = no spouse)	0.009	0.875	0.001	0.988	-0.001	0.979
Education (reference = middle school or lower)						
High school graduate	0.051	0.360	0.054	0.314	0.055	0.296
≥ University	0.071	0.203	0.054	0.317	0.070	0.190
Employment status (reference = no)	0.076	0.174	0.084	0.117	0.073	0.165
BMI (reference = normal weight)	-0.053	0.337	-0.046	0.390	-0.033	0.528
Duration of diabetes (reference < 10 years)	-0.102	0.074	-0.096	0.083	-0.094	0.083
IADL	-0.509	< 0.001	-0.528	< 0.001	-0.482	< 0.001
ADL	-0.094	0.133	-0.081	0.183	-0.083	0.162
Hypertension	-0.152	0.008	-0.134	0.015	-0.098	0.076
Hyperlipidemia	-0.106	0.061	-0.087	0.111	-0.086	0.108
Arthritis	-0.133	0.019	-0.151	0.006	-0.120	0.029
Ischemic heart disease	-0.029	0.590	-0.048	0.364	-0.043	0.408
Cerebrovascular disease	-0.032	0.569	-0.031	0.557	-0.025	0.639
Stress (reference = slightly stressed)			-0.193	< 0.001	-0.190	< 0.001
Physical activity (reference = low)					0.156	0.006
R^2 (ΔR^2)	0.491		0.526 (0.035)		0.543 (0.018)	
F (p)	13.462 (< 0.001)		14.451 (< 0.001)		14.582 (< 0.001)	

Note. ADL, activities of daily living; BMI, body mass index; HRQoL, health-related quality of life; IADL, instrumental activities of daily living.

associated with HRQoL; also, the model accounted for 52.6% of the variation in HRQoL. The statistically significant association of HRQoL with moderate/high physical activity was found using Model 3. This model also increased the explanatory power to 54.3%, above that of Model 2. In all models, there was no multicollinearity among variables.

4. Discussion

A comparison of differences in the dimensions of HRQoL between elderly participants with diabetes who also have disabilities and those without disabilities shows the following. The greatest difference between groups regarded problems with mobility. Elderly individuals with diabetes have more problems with mobility than those without diabetes.[6,7,14] Diabetes and aging cause reduction in joint flexibility leading to lower walking ability.[19] Furthermore, adults with disabilities have more severe problems of mobility both because they have fewer opportunities for physical activity and because the disability itself has a detrimental effect on mobility.[20]

A regression analysis among participants with both diabetes and disabilities showed that dependency in IADL adversely affected HRQoL, which is consistent with previous studies.[11,21] Diabetes and disability are related to increasing dependency in IADL, leading to low HRQoL in elderly.[22,23] In previous studies examining care for elderly individuals, improvement in IADL has been considered a goal of interventions, which are effective in improving IADL and HRQoL.[24] Our findings suggest that it is necessary to consider IADL in providing tailored interventions for elderly individuals with both diabetes and disabilities.

Our study showed that moderately and highly stressed participants with disabilities were more likely to report worse HRQoL, also consistent with other studies.[25–27] Moreover, in order to control their disease, patients with diabetes need to change their lifestyle, which can cause stress.[18,26,27] Additionally, fatigue and pain as complications of diabetes cause high stress.[25] Patients with diabetes are constantly under high stress due to problems related to diabetes, and this stress negatively affects their HRQoL.[27] Further, disability is a strong stressor and a risk factor for low HRQoL among elderly individuals because it is an irreversible impairment that limits ADL.[28–30] Therefore, health professionals need to assess closely the stress levels of elderly individuals with both diabetes and disabilities.

In our study, participants with hypertension or arthritis were more likely to report poorer HRQoL, similar with the findings of several previous studies.[31,32] Hypertension and arthritis in elderly individuals with diabetes are risk factors for physical impairments.[31,32] Further, these individuals frequently need to take multiple medications, and the interactions of these medications can cause adverse effects.[33] In addition, they are burdened with the effort required to manage various diseases including diabetes.[34] Disability increases these burden of self-care because it is a barrier of access to healthcare system.[35] The increased burden of healthcare negatively affects the HRQoL of individuals with disabilities.[35]

Physical activity was positively associated with HRQoL in our study, consistent with other studies.[9,36] Among elderly individuals with diabetes, sufficient physical activity is an important element for glycemic control and is associated with enhancing HRQoL.[37] Disability predicted low physical activity in elderly individuals with diabetes by causing physical and functional limitations.[37] Further, adults with disabilities face barriers to participating in physical activity due to loss of energy and lack of access to physical activity facilities.[20] Thus, our findings could provide evidence of the importance of developing interventions to enhance physical activity for elderly individuals with both diabetes and disabilities.

However, our study has some limitations. Most of the data were self-reported, pointing to a need for objective data, including specific indicators of diabetes (e.g., HbA1c, fasting glucose levels, types of treatments, and diabetes-related complications). Additionally, the sample size of participants with both diabetes and disabilities was relatively small compared to the sample of participants with diabetes but without disabilities. Moreover, EQ-5D-3L, which we used in this study to measure HRQoL, is less sensitive than EQ-5D-5L. Because only data from 2017 were used in this study, further research is needed to analyze longitudinal data regarding HRQoL. We compared our findings to those of previous studies in order to interpret our results; however, this approach was limited due to the paucity of previous studies that specifically targeted elderly individuals with

both diabetes and disabilities. Therefore, our results should be interpreted with caution.

5. Conclusions

Secondary data analysis of nationally representative survey data was of interest to us to study the differences in HRQoL between elderly individuals diagnosed with diabetes and with disabilities, and those without disabilities. It was also of interest in exploring the associations of HRQoL with lower levels of instrumental activities of daily living, hypertension, arthritis, high stress, and higher levels of physical activity in elderly individuals with both diabetes and disabilities, due to adequate sample size and generalizability of the results. Our findings suggest that healthcare professionals should not ignore the complex relationships between disability and HRQoL in elderly individuals with both disabilities and diabetes once physiological factors are taken into consideration.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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