Original Article

Hierarchical Regression of Diabetes Self-Management and Health Related Quality of Life among Older Adults Patients with Type 2 Diabetes Mellitus

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How to cite this article: Nilapa Sukcharoen, Nuchanad Hounnaklang, Pankaew Tantirattanakulchai et. al. Hierarchical Regression of Diabetes Self-Management and Health Related Quality of Life among Older Adults Patients with Type 2 Diabetes Mellitus. International Journal of Nursing Education/Volume 16 No. 3, July - September 2024.

Abstract

Introduction: The global elderly population is experiencing a rising prevalence of diabetes mellitus (DM).As a chronic and noncommunicable disease(NCD), diabetes requires strict daily self-management, significantly affecting the health-related quality of life (HRQOL). We investigated the association between diabetes self-management behaviors and HRQOL in a population of older adults diagnosed with type 2 diabetes mellitus (T2DM).

Methods: This cross-sectional study was conducted between March 2022 and August 2022 at Phramongkutklao Hospital, Bangkok, Thailand. Participants completed questionnaires measuring sociodemographic factors, we utilized the Diabetes Self-Management Questionnaire (DSMQ) and the Diabetes-39 Questionnaire (D-39). Hierarchical linear regression analysis was then employed to investigate the association between diabetes self-management and HRQOL.

Results: A total of 252 participants with a mean age of 68.96 years (SD = 6.64) were included. Our findings revealed a statistically significant positive association between cardiovascular disease (CVD) and HRQOL ($\beta = 0.233$, $P < 0.001$). This indicates that individuals with CVD reported lower HRQOL compared to those without the condition. Similarly, a significant positive association emerged between acute pancreatitis (AP) and HRQOL ($\beta = 0.132$, $P < 0.05$), suggesting a negative impact of this acute illness on HRQOL. Conversely, diabetes self-management demonstrated a significant negative association with HRQOL ($\beta = -0.376$, $P < 0.001$).

Conclusion: This implies that better self-management practices among diabetic patients were linked to improved HRQOL. These findings highlight the crucial role of understanding patient perspectives on diabetes self-management. Nurses and healthcare providers should prioritize investigating these perspectives to develop and implement interventions that deliver effective diabetes self-management education. Such targeted interventions have the potential to significantly enhance the HRQOL of patients living with diabetes.

Keywords: Type 2 diabetes mellitus, Older adult, Nurse and healthcare providers, Health-related quality of life, Diabetes self-management, Exercises, Cardiovascular disease, Acute pancreatitis

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Submission date: April 8, 2024 **Revision date:** April 22, 2024 **Published date: July 31, 2024**

Introduction

Diabetes mellitus (DM) has become a growing public health concern due to its escalating global prevalence, impacting over 537 million individuals in 2021.[1]Projections indicate a concerning rise in this number, with estimates suggesting an increase to 643 million by 2030 and potentially reaching 783 million by 2045.[1] In Thailand, the prevalence of diabetes has shown a steady increase, moving from 7.7% in 2004 to 8.9% in 2014,[2] and reaching 9.7% in 2021.[3,4]The increasing prevalence of T2DM currently poses substantial challenges for global health.[5]

One of the most significant demographic trends of the 21st century is the accelerating growth of the global aging population. Projections indicate that by 2030, one in six individuals worldwide will be aged 60 or over, representing a substantial increase from the estimated 1 billion people in this age group in 2020. This trend is expected to continue, with forecasts suggesting a staggering rise to 2.1 billion individuals aged 60 and above by 2050. Notably, the population segment aged 80 and older is projected to experience a particularly rapid increase, tripling to an estimated 426 million during this same period.[4]Thailand, like many other countries, is experiencing a rapid growth in its older adult population. This trend suggests a potential transition to a completely aged society by 2025 and a super-aged society by 2030.[6,7]

Age is a significant risk factor associated with an increased prevalence of T2DM. This is evident in the observation that individuals over 65 years of age constitute approximately half of all diagnosed cases of T2DM. By 2045, the number of people aged 65 and above diagnosed with diabetes is predicted to increase to 253 million, a significant rise from the estimated 122 million in 2017.[8,9]

T2DM is frequently accompanied by a range of comorbid conditions, which can significantly worsen overall health outcomes. These comorbidities include chronic kidney disease (CKD, CVD, hyperlipidemia, obesity, non-alcoholic fatty liver disease (NAFLD), and pancreatitis.[10, 11]

The primary indicator of T2DM management is glycemic control, typically monitored through the percentage of glycated hemoglobin (HbA1c) levels in the blood.[12] Several studies have suggested that adequate health education and effective diabetes self-management behaviors are associated with improved blood glucose control and better diabetes outcomes.[3, 12-14] Given the large number of cases with inadequate glycemic control, the increasing prevalence of disease complications, and the continuous negative economic impacts on individuals and the healthcare system, T2DM has become one of the major contributors to healthcare costs and has negatively impacted the healthcare system, include nursing productivity, in Thailand.[3]

HRQOL is a specific dimension that contributes significantly to overall quality of life (QOL). Besides, HRQOL serves as a valuable tool for T2DM to self-assess the outcomes of their diabetes care and treatment regimens.[15, 16] Investigating the factors that influence HRQOL in patients with T2DM is essential for developing patient-centered treatment strategies and optimizing nursing care and treatment outcomes.

Effective self-management is a cornerstone of optimal healthcare for patients with chronic diseases, such as T2DM, reducing disease complications, and assisting nurse and healthcare providers in their duties.[17, 18] Stronger self-management skills are associated with a significant improvement in HRQOL among individuals with diabetes, as evidenced by research.[19]

Several sociodemographic characteristics and comorbidities have been identified as influencing HRQOL among T2DM.[15, 20, 21] Age is a significant factor, as the natural aging process in older adults is often accompanied by physiological changes that can negatively impact HRQOL. As life expectancy continues to rise, understanding these factors influencing HRQOL becomes increasingly important to optimize well-being and QOL for individuals living longer with T2DM.

In Thailand, some studies have indicated that understanding the factors influencing HRQOL inT2DM is crucial.[22, 23] However, the literature on the factors affecting HRQOL, especially among older adults with T2DM, remains limited within the Thai context. Given the established association between various factors and HRQOL among T2DMindividuals, particularly older adults, a deeper understanding of these influences is crucial. Therefore, this study

investigates the factors influencing HRQOL in older adults with T2DM, with a specific focus on the association between diabetes self-management behaviors and HRQOL.

Materials and Methods

Participants and Setting

This study was a cross-sectional design. Data were collected from 252 participants recruited at the Out Patient Department of Endocrinology and Diabetes Disease, Phramongkutklao Hospital, Bangkok, Thailand. Patients were eligible if they: 1) had a diagnosis of T2DM, 2) were aged 60 years or older, 3) could communicate in Thai, and 4) were willing to participate. Individuals with sepsis, psychosis, or cognitive impairment were excluded. This research obtained approval from the Institutional Review Board of the Royal Thai Army Medical Department (IRBRTA 1654/2564). All participants were provided informed consent documents outlining the study's objectives by the nurse at the study site. This research adhered to the Declaration of Helsinki and the Belmont Report's ethical principles.[24]

Measurements

Sociodemographic Variables

This study incorporated a range of sociodemographic variables to understand the characteristics of the participants. The variables covered gender, age, marital status, educational attainment, income level, hypertension, CVD, CKD, dyslipidemia, AP, exercise and the duration of living with T2DM as a relevant factor.

The Impact of Diabetes Self-management Questionnaire (DSMQ)

To evaluate self-management behaviours related to glycemic control, this study utilized DSMQ developed by Thojampa and Mawn.[25] This 16-item questionnaire aligns with the framework proposed by Schmitt et al.[26] Participants responded using a four-point Likert scale, ranging from 0 ("does not apply to me") to 3 ("applies to me very much"). Higher total scoresindicated greater self-management practices related to diabetes. The DSMQdemonstrated excellent internal consistency in this study, with a Cronbach's alpha coefficient of 0.90.

The Diabetes-39 Questionnaire(D-39)

We employed the Thai version of the D-39 developed by Songraksa and Lerkiatbundit[27]to evaluate HRQOL of the participants. The D-39 is a comprehensive tool encompassing 39 items. Participants responded using a seven-point Likert scale ranging from 1 ("not affected at all") to 7 ("extremely affected"), with higher scores indicating a lower HRQOL. The D-39 demonstrated excellent internal consistency in our study, with a Cronbach's alpha coefficient of 0.98.

Statistical analysis

Data were analyzed using SPSS 28.0. Descriptive characteristics of the older adults with T2DM were determined. Hierarchical linear regression analysis was performed to investigate factors influencing HRQOL. HRQOL served as the dependent variable. Three models were constructed with increasing levels of complexity. Model 1 included sociodemographic characteristics (age, gender, education, income, and exercise). Model 2 added comorbidities (hypertension, CVD, CKD, dyslipidemia, and AP) as predictors. Model 3 further incorporated diabetes self-management. Standardized beta coefficients (β) were used to assess the impact of each variable on HRQOL while controlling for other factors in the model. A significance level of $p < 0.05$ was applied.

Results

Demographic Characteristics of the participants

The study recruited 252 older adults diagnosed with T2DM. Participants' ages ranged from 60 to 90 years, with an average age of 68.96 years (SD ± 6.64). The majority of participants were aged 60-69 years (57.0%), female (59.9%), married (81.0%), with an undergraduate education (56.7%), and had an income lower than or equal to 40,000 baht (76.6%). A significant portion did not engage in exercise (54.4%). Regarding comorbidities, hypertension (82.1%), dyslipidemia (77.0%), CVD (27.8%), CKD (19.4%), and AP (1.2%) were prevalent among the participants (Table 1).

Table 1 Demographic Characteristics of the participants (n = 252)

Individual characteristics	n	%
Gender		
Female	108	42.9
Male	144	57.1
Age		
60 – 69 years	151	59.9
70 – 79 years	82	32.5
≥ 80 years	19	7.5
Rage	60 - 90	
Mean ± SD	68.96 ± 6.64	
Marital status		
Single	18	7.1
Married	204	81.0
Widowed	25	9.9
Divorced	5	2.0
Education		
Undergraduate	143	56.7
Bachelor- Postgraduate	109	43.3
Income		
≤ 40,000 baths	193	76.6
>40,000 baths	59	23.4
Exercise		
No	137	54.4
Yes	115	45.6
Hypertension		
No	45	17.9
Yes	207	82.1
Cardiovascular Disease		
No	182	72.2
Yes	70	27.8
Chronic Kidney Disease		
No	203	80.6
Yes	49	19.4
Dyslipidemia		
No	58	23.0
Yes	194	77.0
Acute pancreatitis		
No	249	98.8
Yes	3	1.2

Simple linear regression analysis

Table 2 Hierarchical Linear Regression Analysis for Predicting HRQOL

Variable	Simple Linear Regression		Hierarchical Regression		
	Standardized Beta	R^2	Standardized Beta		
			Model 1	Model 2	Model 3
Characteristic					
Age	0.007	0.000	-0.025	-0.048	-0.040
Gender	0.019	0.000	-0.004	0.019	-0.018
Education level	-0.034	0.001	-0.048	-0.020	-0.006
Income	0.043	0.002	0.051	0.053	0.019
Exercise	-0.209***	0.044	-0.207**	-0.191**	-0.027
Comorbidity					
Hypertension	0.023	0.001		0.022	0.007
Cardio Vascular Disease	0.230***	0.053		0.230***	0.233***
Chronic kidney Disease	-0.028	0.001		-0.021	-0.045
Dyslipidemia	-0.101	0.010		-0.069	-0.008
Acute Pancreatitis	0.198**	0.039		0.165	0.132*
Diabetes Self-Management	-0.391***	0.153			-0.376***
R^2			0.047	0.137	0.243
Note:* p<0.05,** p<0.01,*** p<0.001					

The study performed Simple linear regression analysis to explore the association between individual variables and HRQOL. CVD emerged as the strongest predictor of HRQOL, with a standardized beta coefficient (β) of 0.230 (R^2 = 0.053). This indicates a positive association, suggesting that participants with CVD reported lower HRQOL scores. Additionally, negative correlations were observed between HRQOL and both exercise (β = -0.209, R^2 = 0.044) and diabetes self-management (β = -0.391, R^2 = 0.153). These findings imply that more frequent exercise and better diabetes self-management practices are associated with higher HRQOL scores in older adults with T2DM (Table 2).

Hierarchical linear regression analysis

Hierarchical linear regression analysis was conducted to explore the combined effects of different factors on HRQOL in older adults with T2DM (Table 2). This analysis involved building the model in three steps, with each step adding a new block of predictors. The final model (Model 3) revealed several key findings. First, CVD emerged as a significant and positive predictor of HRQOL (standardized β = 0.233, P < 0.001). This suggests that individuals with CVD reported lower HRQOL compared to those without the condition. Additionally, AP was also significantly and positively associated with lower HRQOL (standardized β = 0.132, P < 0.05), highlighting its negative impact on overall well-being. Notably, diabetes self-management demonstrated a significant negative association with HRQOL (standardized β = -0.376, P < 0.001).

Discussion

It was found that T2DM is a highly prevalent chronic health condition that significantly affects older adults.[1] Beyond the physiological consequences, T2DM can substantially impact a patient's HRQOL.

In the current healthcare paradigm, nurses and healthcare providers focus not only on extending life expectancy on enhancing QOL as a metric to evaluate the effectiveness of medical interventions.[28]HRQOL is a well-established concept that centers on the impact of illness and, more specifically, the influence of treatment on a patient's overall well-being.[29, 30] Given the multidimensional and dynamic concept of HRQOL,[30]understanding the factors that affect HRQOL is crucial.

Our hierarchical regression analysis revealed that diabetes self-management emerged as a significant predictor of HRQOL. This recommends that older adults with T2DM who practiced better self-management behaviours reported higher HRQOL, suggesting that effectiveness in self-management is a key role in improving HRQOL for older adults with T2DM. The study also identified associations between certain health conditions and HRQOL. Specifically, CVD and AP were associated with lower HRQOL, highlighting their negative impact on overall well-being.

Our study found that 27.8% of older adults with T2DM reported having CVD, while 72.2% did not. This translates to a roughly 1:3 ratio of patients with versus without CVD, which aligns with findings from global prevalence surveys.[31]HRQOL serves as a well-established, multidimensional metric for assessing the influence of disease and treatment on a patient's overall functioning and well-being.[32]According to the literature, the relationship between cardiovascular health and HRQOL has been demonstrated and indicated that it may also worsen the QOL.[33-35]

Early detection strategies and prevention of CVD as a complication of T2DM is crucial. The important role of nurse as a healthcare team is increasingly being used for CVD assessment tools. Currently, to reflect the effects of various interventions, CVD risk assessment tools, such as the Framingham Risk Score (FRS) and the Systematic Coronary Risk Evaluation (SCORE), are increasingly used in clinical practice to identify or predict the risk in individuals.[36, 37] Consideration for further improvement in modifiable CVD risk assessment in T2DM patients and the management of HRQOL in people with T2DM should be given more importance.

Our study also identified acute pancreatitis as another significant comorbidity in older adults with T2DM. Specifically, 3 (1.2%) of the participants reported a history of AP. The observation regarding the increased risk of AP in older adults with T2DM aligns with previous research by Lai et al.[38] Their Asian population-based cohort study reported a twofold higher incidence of AP among diabetic patients compared to non-diabetics.

Acute pancreatitis, a condition known to disrupt blood glucose control,[39] is associated with high morbidity and mortality.[40] Moreover, patients with diabetes appear to have a higher risk of death and readmission compared to those without diabetes.[40]

Our study has shown that T2DM patients with AP reported lower HRQOL. Patients with pancreatitis experience a reduced QOL[41] and may face a decrease in life expectancy.[42, 43] Although most cases of AP can be fully recovered after standard treatment, a subset of patients may suffer from recurrent episodes.[41] Early diagnosis of AP, especially in older adults with T2DM, is vital for timely standard treatment.

Effective management of diabetes mellitus by patients requires a comprehensive set of self-management behaviors. In practice, diabetes self-management is health-related quality of life's key determinant.[44] Patients with T2DM and complications experienced a substantial decline in HRQOL which implied that improved diabetes management are crucial to prevent diabetic complications and related HRQOL.[45, 46] In essence, a strong commitment to diabetes self-management can lead to a better HRQOL.[47]

Our finding aligns with previous studies, which have provided evidence that diabetes self-management is strongly associated with HRQOL in patients with T2DM.[48]

To our best knowledge, the diabetes self-management on HRQOL's impact in T2DM is not uniform across all age groups.[49] The HRQOL is seen as a predictor of people's ability to maintain long-term health, well-being, and productivity.[50,51] Furthermore, given the significance of aging-related diseases and their complications,[52] improving the QOL among people with T2DM, including older adults, is essential.

In Thailand, nurses function as the primary healthcare providers for many patients. This proximity positions them to collaborate on usual care, deliver health education, and guide lifestyle modifications for diabetic patients. Investigating patient perspectives on these interventions is crucial for developing and implementing targeted strategies that promote effective diabetes self-management education. Such tailored interventions have the potential to significantly improve the HRQOL for individuals living with diabetes.

Strength and Limitation

Admittedly, our study has inherent limitations. Firstly, the reliance on self-reported data for collection. While this approach offers valuable insights from participants themselves, it can introduce information bias. Secondly, the study's cross-sectional design prevents us from establishing causal relationships between diabetes self-management and HRQOL. We can identify associations, but this design cannot definitively prove that better self-management leads to improved HRQOL.

Despite the limitations, this study offers key findings. First, we employed scales validated in the Thai context, ensuring the cultural relevance of our findings for the target population of older adults with T2DM in Thailand. Second, our study design explored the associations between HRQOL and various factors in this specific population. This information is particularly crucial for Thailand, considering its rapidly aging society.

Conclusions

This implies that older adults with T2DM who engaged in more consistent self-management behaviors reported higher HRQOL. These findings hold significant value for nurses and healthcare professionals in Thailand. They can utilize this knowledge to develop targeted interventions aimed at improving HRQOL in older adult patients with T2DM. Our study paves the way for future research on intervention methods tailored to address the identified predictors of HRQOL in this population group. Furthermore, considering the substantial variations observed among individuals, it reinforces the recommendation to incorporate routine assessments of self-rated HRQOL into standard healthcare practices.

Acknowledgements: The authors would like to express their sincere gratitude to Phramongkutklao Hospital for granting the necessary permissions to conduct this study and, especially many thanks to all the participants who generously volunteered their time and shared their experiences. Their invaluable contributions were essential to this research.

Ethical Clearance: This research obtained approval from the Institutional Review Board of the Royal Thai Army Medical Department (IRBRTA 1654/2564).

Conflict of Interest: All authors disclose no conflict of interest.

Source of Funding Statement: No financial assistance or grants were provided for this study.

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