

Original Paper

Relationship Between Caregiver Burden and Cognitive Impairment in Adult Patients with Type 2 Diabetes



Sorur Javanmardifard¹, Fatemeh Shirazi², Sheida Jamalnia^{3*}, Erfan Sadeghi⁴

1. Nursing (PhD), Instructor, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran.
2. Assistant Professor, Community Based Psychiatric Care Research Center, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran.
3. Medical Journalism (MSc), School of Paramedical sciences, Shiraz University of Medical Sciences, Shiraz, Iran.
4. Biostatistics and Epidemiology (Ph.D), Research Consultation Center (RCC), Shiraz University of Medical Sciences, Shiraz, Iran.



Citation Javanmardifard S, Shirazi F, Jamalnia Sh, Sadeghi E. Relationship Between Caregiver Burden and Cognitive Impairment in Adult Patients with Type 2 Diabetes. *J Holist Nurs Midwifery*. 2022; 32(3):203-209. <https://doi.org/10.32598/jhnm.32.3.2207>

Running Title Caregiver Burden and Cognitive Impairment in Diabetes

doi <https://doi.org/10.32598/jhnm.32.3.2207>



Article info:

Received: 01/03/2021

Accepted: 23/01/2022

Available Online: 01/07/2022

Keywords:

Caregiver burden, Cognitive function, Diabetes Mellitus

ABSTRACT

Introduction: Caregivers play a critical role in health management of patients with chronic diseases. Caregiving is associated with experiencing different emotional and psychological problems.

Objective: This study aims to determine the relationship between caregiver burden and cognitive function in adult patients with Type 2 Diabetes (T2D).

Materials and Methods: In this cross-sectional study, 215 family caregivers of adult patients with T2D were selected by a systematic random sampling method. A socio-demographic form, the Caregiver Burden Inventory (CBI), and the Mini-Mental State Examination (MMSE) were used for data collection. Data were analyzed using Kruskal-Wallis test, Spearman's rho correlation test. The multinomial logistic regression model was used to examine the power of Cognitive Impairment (CI) in predicting the caregiver burden. $P < 0.05$ was considered as the statistically significance level.

Results: The mean age of caregivers and patients were 48 ± 9 and 52 ± 2 years, respectively. The mean score of CBI was 24.57 ± 18.2 , indicating a moderate level of caregiver burden. The mean score of MMSE was 25.25 ± 3.6 , indicating a mild CI in patients. Caregiver burden showed a significant correlation with cognitive function ($r = -0.336$, 95% CI: 0.53–0.89, $P = 0.001$) such that the decreased CI was associated with an increase in total caregiver burden ($r = -0.348$, 95% CI: 0.43–0.87, $P = 0.001$). The regression results showed that the CI levels were not predictors of caregiver burden severity.

Conclusion: The CI of patients with T2D may affect their caregivers' burden. Therefore, assessing the cognitive function of these patients can help healthcare providers conduct interventions to enhance the caregivers' quality of life.

* Corresponding Author:

Sheida Jamalnia, MSc

Address: School of Paramedical sciences, Shiraz University of Medical Sciences, Shiraz, Iran.

Tel: +98 (933) 2721342

E-mail: Sh.jamalnia1988@gmail.com

Highlights

- More than half of patients with type 2 diabetes had normal cognitive function to mild cognitive impairment.
- Most of caregivers reported moderate burden.
- Higher level of Cognitive Impairment (CI) in diabetic patients may cause an increase in the caregivers' burden.

Plain Language Summary

This study aimed to assess the relationship between caregiver burden and Cognitive Impairment (CI) in adult patients with Type 2 Diabetes (T2D). Many caregivers of these patients, particularly females suffer from psychological distress due to caregiving job. In order to enhance the quality of care for these patients, physicians should assess the burden of caregivers. Our results demonstrated that the caregivers had a moderate level of burden and the patients had mild cognitive impairment. Caregiver burden showed a significant correlation with cognitive impairment. Accordingly, increase in cognitive impairment was accompanied by an increase in the severity of caregiver burden. However, the cognitive impairment level were not the significant predictors of caregiver burden severity. It can be concluded that the cognitive function of patients with T2D may affect their caregivers' burden.

Introduction

Diabetes is a costly disease due to causing various complications [1, 2]. The chronic nature of diabetes and its related complications are associated with both tangible and intangible costs for patients and their caregivers, and reduce the patients' quality of life [3, 4]. According to the International Diabetes Federation (IDF), three out of four individuals with diabetes (352 million people) are of working age (20–64 years of age). This figure is expected to increase to 417 million by 2030 and 486 million by 2045. In 2019, approximately 54.8 million people aged 20–79 years (12.8%) in the Middle East and North Africa were diagnosed with diabetes, along with a total of 24.5 million adults whose diabetes was undiagnosed. Pakistan (19.4 million), Egypt (8.9 million), and Iran (5.4 million) are the countries with the highest number of diabetic adults aged 20–79 years. In Iran, the prevalence of diabetes among adults aged 20–79 years in 2019 was reported 9.4% (ranged 7.4–12.3%) [5].

The effects of diabetes are not limited to early and late complications such as hyperglycemia and those related to the small and large arteries [6]. Diabetes can cause primary and secondary disorders as well as the central nervous system complications such as cognitive dysfunction [7]. Cognitive Impairment (CI) is one of the less known complications of Type 2 Diabetes (T2D) [8]. The prevalence of diabetes in people with CI ranges 6–39% [9]. The CI includes reduced information processing speed, concentration, memory, learning ability,

problem-solving ability, visual intelligence, and mental flexibility [10]. It negatively influences self-care behaviors. Poor glycemic control has been shown to be a risk factor for CI [11]. Furthermore, diabetes can worsen cognitive aging, which is a risk factor for CI. Therefore, the caregivers should pay attention to the CI of diabetic patients [12].

The burden of care for diabetic patients is heavy due to the deteriorating nature of the disease, which may affect the caregivers' daily activities [12]. In caring for patients with diabetes, 66.7% and 22.5% of family caregivers experience objective and subjective family burdens, respectively [13, 14]. Caregiver burden is not only associated with negative emotional conditions and psychological disorders; it has other physical, financial, and social consequences. Compared to non-caregivers, caregivers are more likely to have poor health, seek medical treatment, and take psychotropic medicines more frequently [15]. The caregiver burden is also associated with negative consequences for the patients and is closely related to their institutionalization [16]. Caregivers with a previous history of psychiatric disorders are more prone to relapse [1]. Connors et al. reported high levels of caregiver burden in caregivers of people with mild CI [3]. Patients' higher levels of neuropsychiatric symptoms, decreased functional ability, and loss of driving abilities as well as the caregivers' occupational challenges are associated with increased caregiver burden over time [17]. Jane et al. reported that many Nigerian caregivers of patients with T2D experienced the burden and psychological distress as a result of caregiving tasks [18].

There is a need for more research in Iran on the impact of diabetes on caregivers. Most of the studies on caregiver burden have been conducted in Western countries. Since Asian countries have diverse cultures, the focus on the psychosocial aspects can be beneficial. The difference in cultures can lead to different results. According to studies, caregivers of T2D patients have heavy care burden, psychological distress, and psychological illnesses such as depression and anxiety [18, 19]. The present study aims to determine the relationship between caregiver burden and CI in adult patients with T2D.

Materials and Methods

In this cross-sectional study, 215 patients with T2D were selected from those referred to Shiraz Diabetes Association clinic from July 2017 to July 2018 using a random sampling method who met the eligibility criteria. The sample size was determined 215 based on Green's formula for regression sample size: $N \geq 50 + 8k$ [20] where k (the number of independent variables) was set at 20. However, to prevent possible dropout, the sample size was increased to 225. One in three patient/caregiver dyads who met the inclusion criteria were selected each day from the clinic during the study using systematic random sampling. Inclusion criteria for patients were age 25–65 years, diagnosis of T2D based on the 1999 World Health Organization's diagnostic criteria for diabetes, suffering from diabetes for more than a year, and having at least a primary school education. Inclusion criteria for caregivers were: Being a caregiver of patients with T2D, age ≥ 18 years, caregiving for at least 6 months, willingness to participate, being the patient's first-degree relatives (child, spouse, father, mother, sister, or brother), living with the patient, care for the patient solely because of diabetes or its complications, no history of mental disorders or participation in psychotherapy courses, and not suffering from disabling physical diseases due to taking care of the patient. The exclusion criteria were incomplete return of the questionnaire.

The data collection tool was a socio-demographic form, the Mini-Mental State Examination (MMSE), and the Caregiver Burden Inventory (CBI). The MMSE or Folstein test is a 30-point questionnaire used to assess CI in clinical and research settings. This instrument was developed by Folstein et al. for brief quantitative assessment of cognitive function. It can screen and assess the CI severity, and monitor the changes. Its items assess various cognitive areas, including orientation in time and place, repetition, verbal recall, attention and calculation, language, and visual construction. It takes 5–10 minutes to

complete. The total score ranges from 0 (impaired) to 30 (normal). Accordingly, scores 0–9, 10–20, 21–26, and 27–30 represented severe, moderate, mild CI, and normal cognitive function, respectively [21]. Using a cut-off score of < 24 , MMSE was found to be 87% sensitive and 82% specific in detecting dementia and delirium among hospital patients [22]. In a study by Foroughan and et al., results showed acceptable reliability and validity of the Persian version of MMSE [23]. The MMSE questionnaire was completed by the researcher for the patients.

The caregivers were assessed using the CBI. This diverse, multidimensional instrument was developed by Novak and Guest to measure the care burden in caregivers [24]. It has 24 items and 5 subscales. There are five items for each subscale, except for the physical subscale which contains four items: Time dependence (burden due to shortage of time; items 1–5), developmental (sense of failure in meeting role expectations and enjoying opportunities compared to the peers; items 6–10), physical (feeling of fatigue and chronic health problems; items 11–14), social (due to perceived conflict of roles; items 15–19), and emotional (due to negative feelings towards the patients due to their bizarre and unpredictable behaviors; items 20–24). The items were scored on a five-point Likert scale from 0 (not at all disruptive) to 4 (very disruptive). Thus, the total score of each subscale range from 0 to 20, except for the physical subscale which had four items. Therefore, the total CBI score ranges from 0 to 96, with higher scores representing higher burdens. Accordingly, scores 0–19, 20–50, and 51–96 represent normal to mild, mild to moderate, and moderate to severe burdens, respectively. The CBI takes approximately 10–15 minutes to complete. The Persian version of CBI which was localized by Shafizadeh et al. [25] were used in this study.

The continuous variables were described by mean and standard deviation, while the categorical variables were presented by percentage. Kolmogorov-Smirnov test was used to analyze the normality of data distribution. Difference between different CI levels were analyzed using Kruskal-Wallis Test. The correlation between the continuous variables were evaluated using Spearman's correlation test. The multinomial logistic regression model was used to examine the power of CI in predicting the caregiver burden after adjusting socio-demographic variables. All statistical analyses were performed in SPSS v. 24 software, and $P < 0.05$ was considered as the statistically significance level.

Results

In this study, 10 caregivers did not complete their questionnaires. Thus, they were excluded from the study, and the research was carried out on 215 caregivers. The mean age of caregivers and patients were 48 ± 9 and 52 ± 2 years, respectively. The majority of caregivers were female (78.6%) and married (91.6%). Most of them were daughters (35.3%) and spouses (35.3%) of the patients, and had lower than high school education (47.9%). Moreover, T2D had presented in 65.1% of patients after the age of 60 years. The mean score of MMSE was 25.25 ± 3.6 in the patients; 46.5% had normal cognitive function, 46.5% had mild CI, and 7% had moderate CI. Furthermore, most of the caregivers (45.8%) reported moderate burdens (Table 1). The mean score of CBI was 24.57 ± 18.2 .

A decrease in CI level was correlated with an increase in total level of caregiver burden ($r = -0.348$, $P = 0.001$), and an increase in the severity of caregiver burden ($r = -0.366$, $P = 0.001$) based on Spearman rho test. There was no significant difference between caregiver burden severity and CI levels (Table 2). The multinomial logistic regression results showed that the CI levels were not predictors of caregiver burden severity after adjusting demographic variables (Table 3).

Discussion

The present study indicated that most patients had a normal to mild CI. No severe CI case was detected. Moattari et al. in their study also found no T2D patient with severe CI; most of patients had normal to mild CI. Caregivers may experience a high level of burden when caring for T2D patients, which can seriously affect the patients' lives [26]. The number of patients with T2D and CI or dementia is expected to increase worldwide

Table 1. Demographic characteristics of caregivers (n=215)

Characteristics		No. (%)
Gender	Male	46(21.4)
	Female	169(78.6)
Marital status	Single	19(8.4)
	Married	196(91.6)
Occupation	Employed	83(38.6)
	Retired/not working	48(22.3)
	Housekeeper	84(39.1)
Educational level	Lower than high school education	103(47.9)
	Bachelor's degree or lower	93(43.3)
	Higher than bachelor's degree	19(8.8)
Relationship with patient	Son	63(29.3)
	Daughter	76(35.3)
	Spouse	76(35.3)
History of psychiatric disorders	No	186(86.5)
	Yes	29(13.5)
Caregiver burden severity	Low	97(45.3)
	Mild	98(45.8)
	High	19(8.9)

Table 2. Caregiver burden based on Cognitive Impairment (CI) levels

Caregiver Burden	No. (%) / Mean ± SD				P*
	CI level				
	Normal (n=100)	Mild (n=100)	Moderate (n=15)	Total (n=215)	
Low	46(46.9)	43(43.9)	9(9.2)	98(100)	0.793
Mild	46(46.9)	47(48.0)	5(5.1)	98(100)	
High	8(42.1)	10(52.6)	1(5.3)	19(100)	
Total Caregiver burden	23.68±17.58	25.48±18.09	24.40±23.21	24.57±18.18	0.711

*Kruskal-Wallis Test

due to the prevalence of diabetes and the concomitant rise in adult populations. In this respect, dementia can be a new long-term diabetic complication with emotional consequences for the affected individuals and their families, and with a significant effect on healthcare providers. Therefore, more studies for recognizing T2D patients at risk of dementia are required.

The results of the present study showed a significant correlation between the caregiver burden and cognitive function. Higher level of CI in patients may increase the caregivers' burden. This implies that the caregiver burden can be decreased by modifying the patient's cognitive function. Similarly, Lara-Ruiz et al. found that the patients' neuropsychological scores predicted caregiver burden less than their daily functioning [15]. Caring for another person may be perceived as stressful job. Family caregivers spend emotional, financial, and physical costs to be constantly available to family members. Our

findings confirmed the presence of burden among the caregivers of T2D patients with CI, with a prevalence of about 36%. There are increased caregiver burden when patients become more disable and require more assistance with, for example, financial and medication management. In this study moreover increased caregiver burden is associated with a longer course of CI and greater cognitive, behavioral and emotional problems among the patients.

Our results showed a mild to moderate caregiver burden among the caregivers of diabetic patients with different CI levels. This burden may be due to the chronic nature of the disease, the patients' disability in self-care, the caregivers' increased responsibility, inadequate attention to the caregivers as a member of healthcare team, caregivers' lack of satisfaction, and socioeconomic factors. The caregivers need for rest, being alone, and being with friends may be neglected due to caregiving

Table 3. Multinomial logistic regression model for assessing the predictive role of Cognitive Impairment (CI) to Caregiver burden

CI	Caregiver Burden	Beta	Standard Error	OR	95% CI		P
					Bound		
					Lower	Upper	
Mild	Low	-0.547	0.555	0.579	0.195	1.718	0.325
	Mild	-0.390	0.548	0.677	0.231	1.982	0.477
	High	-	-	-	-	-	-
Moderate	Low	0.497	1.171	1.644	0.166	16.324	0.671
	Mild	-0.128	1.202	0.880	0.083	9.280	0.915
	High	-	-	-	-	-	-

Note: normal level of cognitive impairment was considered as reference adjusted for age, gender, educational level, occupation, marital status, relationship with patient, disease history, and disease onset.

responsibilities. They have individual and social needs. With increase in the disease complications including CI, the patient may become more dependent on the caregiver, leading to more difficult caregiving job. Caring for a diabetic patient with various levels of CI has specific challenges [20]. Caro et al., however, demonstrated that the caregivers had moderate levels of burden [16]. This discrepancy in the results may be due to difference in the study populations and the instruments used.

Female caregivers, even those who are not mothers, are more common in Iran and receive less support and have less resting compared to male caregivers. This is also common among other low and middle-income countries, particularly among poor families. The social determinants can affect or hinder the successful caregiving for the patients [27]. In Iranian society and culture, women are primarily selected for taking care of patients and the elderly. Studies have also reported that females make up the majority of family caregivers [3, 17].

Given that in this study, a questionnaire was used for assessing caregiver burden which may not reflect the complete caregiver burden. Other methods are required to recognize the risk factors among caregivers, and planning should be done for providing support to them. On the other hand, hiring a professional nurse can place less burden on caregivers. Health care providers and policymakers should pay more attention to this important issue and take proper measures in the field of care for diabetic patients to reduce the burden of care in families' members.

There is a moderate caregiver burden among the caregivers of T2D patients with CI. Steps should be taken to reduce burden among the caregivers to enable them to provide the best healthcare services to the patients. Otherwise, they may experience problems which can disturb their caregiving role.

Ethical Considerations

Compliance with ethical guidelines

This research received ethical approval from the ethics committee of Shiraz University of Medical Sciences (Code: IR.SUMS.REC.1397.262). Written informed consent was obtained from the participants.

Funding

This study was funded by Shiraz University of Medical Sciences.

Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgments

The authors would like to thank Shiraz University of Medical Sciences for their financial support, and all diabetic patients and their caregivers for their cooperation.

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