

Examining the factors of burden among family caregivers of older adults with diabetes mellitus regarding a development model

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Abstract

The present study aimed to examine the factors contributing to burden among family caregivers of older adults with diabetes mellitus (DM), with regard to the characteristics of older adults as well as those of caregivers, caregiving self-efficacy and caregiver behavior toward diabetes support and social supports based on a conceptual development model. In total, 151 family caregivers who were children or spouses responded (93.8%). In this cross-sectional study, primary family caregivers were personally interviewed using a set of anonymous structured questionnaires for data collection from one hospital in Northern Vietnam. We examined the factors contributing to caregiver burden via linear regression analysis and pathway analysis.

Most family caregivers were under 60 years old (66.9%) and female (74.2%). Linear regression analysis indicated that family caregivers with chronic illness status ($\beta = .20$), the number of hours of caring for older adults ($\beta = .15$), self-efficacy ($\beta = -.16$), and caregiver behavior toward DM care support ($\beta = -.39$) were all significant factors contributing to caregiver burden ($F = 10.395$, $p < .001$, $\text{Adj}R^2 = .41$). Pathway analysis showed that chronic illness status was a significant direct predictor of caregiver burden, whereas the number of hours of caring for older adults both directly and indirectly predicted caregiver burden via mediators including self-efficacy and caregiver behavior toward DM care support ($\chi^2 = 1.021$, $df=1$, $p = .312$, $CFI = 1.000$, $GFI = .997$, $SRMR = .000$, and $RMSEA = .000$).

The characteristics of caregivers and their responsibility for older adults should be considered to decrease the burden of caregivers. Nursing intervention, social support, increased self-care and the acquisition of caregiving knowledge and skills might help in reducing family caregiver burden.

KEY WORDS

burden, caregiver, diabetes mellitus, self-efficacy, pathway

Introduction

According to International Diabetes Federation (2019), diabetes mellitus (DM) was found in 135.6 million people in aging population in 2019. It has been

estimated to rapidly increase by 1.5 and 2 fold in 2030 and 2045, respectively¹⁾. In Vietnam, 11.7% of older adults have DM²⁾, and this disease is one of the top 10 diseases causing death and disabilities in 2017³⁾. DM

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increases the risks of cardiovascular disease, stroke, renal failure, retinopathy, and peripheral vascular disease⁴). In addition, older adults with DM are associated with cognitive impairment such as dementia and physical mobility disability such as amputation^{5, 6}). With a decline in the health status of older adults with DM, their activities of daily living (ADLs), self-care^{7, 8}), and diabetes self-care⁹) also decline. Therefore, these older adults require assistance to execute their ADLs and efficiently manage their DM¹⁰).

Family caregivers who provide caregiving activities to older adults with DM increasingly experience burden. These family caregivers are involved in caregiving activities such as providing assistance for performing ADLs, taking medication, checking DM complications, supporting physical exercise, and making decision^{11, 12}). These responsibilities require a substantial amount of time¹³), and performing hand-on care restricts the caregivers from having private time and exposes them to physical harm. In addition, several family caregivers are unaware regarding the accurate manner to provide the appropriate care because of lack of DM knowledge, caregiving skill, and support from professional health staff and other family members^{12, 13}). Consequences of caregiving issues that are prone to both physical and psychological burden include poor health status, depression, anxiety, and stress^{14, 15}).

In Vietnam, most older adults live with their families, and 90% of the older adults need daily care¹⁶). Family caregivers not only play a role as supporting care at home but also as supporting care at hospital when older adults have illness and fatigue due to the traditions of Vietnamese family¹⁶). The limitation of supportive environment, such as facilities in home environment, and place for physical activities was pointed out as a burden for people with diabetes in Vietnam¹⁷). Furthermore, the incidence of lack of awareness about diabetes was more than 50%, indicating poor self-management among these patients with DM¹⁷).

Determining the factors of burden is essential to prevent caregiver burden and improve their competence in providing care. Several literature reviews regarding certain aspects such as the caregiver burden in patients with cancer, heart failure, and Alzheimer's disease have been conducted^{18, 19, 20}). With regard to caregiving in patients with DM, only one study investigated the

factors contributing to the burden of family caregivers in providing diabetic care. However, this study particularly surveyed caregivers dealing with a patient with type 2 DM who was amputated after operation and analyzed factors of burden without pathway analysis²¹). Therefore, there is a need for a study on family caregivers of older adults with DM, who experience various challenges, with regard to maintaining their responsibilities in providing assistance and reducing their caregiving burden.

Family caregiver burden involves various potential factors. The characteristics of patients were considered as important factors^{19, 22}). Furthermore, the characteristics of family caregivers were reported as substantial factors of caregiver burden^{21, 23}). Social support reportedly reduces caregiver burden^{19, 24}). On the other hand, the individual's belief of their abilities in providing care as well as their behavior can aid in coping with caregiving-related issues²⁵), indicating that caregiver self-efficacy and caregiver behavior toward DM support are important resources while experiencing psychological challenges such as depression and burden^{25, 26}). The present study was designed to elucidate the knowledge gap related to factors of caregiver burden and to provide helpful advice for alleviating such burden and improving the caregiver self-efficacy and behavior. We hypothesized that the family caregiver burden was affected from factors including the characteristics of older adults and family caregivers as well as social support, caregiver self-efficacy, and caregiver behavior toward DM care support. This study aimed to examine the factors of burden among family caregivers of older adults with DM with focus on characteristics of older adults as well as those of caregivers, caregiving self-efficacy, and caregiver behavior toward diabetes support and social supports based on a conceptual development model.

Methods

1. Conceptual framework

We developed a hypothetical model for the present study to investigate the factors of burden (Figure 1) according to the stress process model by Pearlin²⁷), self-efficacy theories by Bandura^{28, 29}), and caregiver behavior toward DM support by Scarton²⁶). Burden comprises four dimensions—the caregiver's emotional, physical,

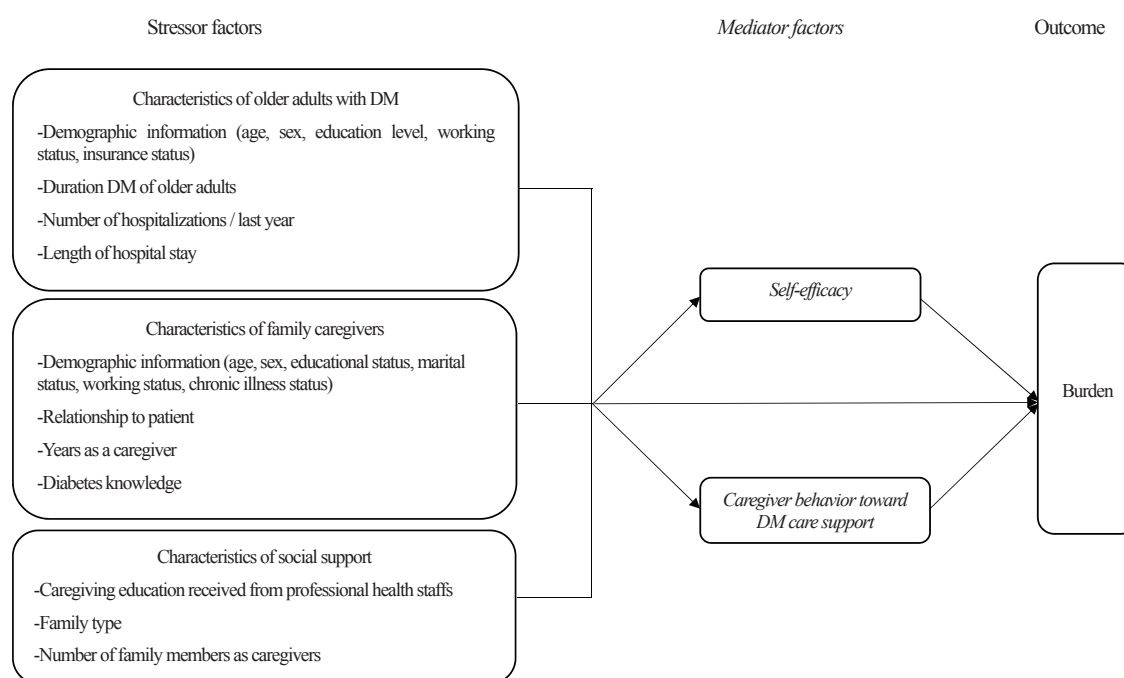


Fig 1: Hypothetical model of burden among family caregivers of older adults with diabetes mellitus (DM)

social, and financial distress^{30, 31}). The stress process model helps clarify the various dimensions of burden, emphasizing an influence by various factors²⁷). Such a model was adopted in the present study to investigate different stressor factors including the characteristics of patients, caregivers, and social support. The mediator factors comprised caregiver self-efficacy and caregiver behavior toward DM care support. These factors constitute the core of this conceptual framework because these variables were considered as motivations influencing the caregiver burden. Self-efficacy is conceptualized as the belief of the individual in confidently performing their tasks³²). Caregivers with high self-efficacy can better improve their well-being, thereby reducing stress and burden²⁸). However, various factors, including resources from family and society, might influence the caregiver self-efficacy²⁹). Caregiver behavior toward DM care support involves caregiver perception regarding DM and their coping mechanism in response to caregiving as well as handling patient emotion and behavior and providing physical care^{26, 33}). We used the findings of a study by Scarton²⁶) to add more critical factors measuring caregiver behavior during DM care for older adults; that study indicated that the impairment of caregiver behavior is associated with an increase in depression status. A poor behavior in the caregiving role may primarily require

DM knowledge, caregiving skill, and social support to overcome the difficulties in caregiving.

2. Study design and participants

An anonymous structured questionnaire was given via face-to-face interview with a researcher because some respondents were expected illiterate. The hospital is a healthcare center for the northern coastal region, which includes five cities, namely Hai Phong, Quang Ninh, Thai Binh, Nam Dinh, and Ninh Binh. There are 1000 patient beds in this hospital, which are used by the departments of internal medicine and surgical medicine and the intensive care unit; there were no nurses who had advanced certification associated with DM care. Convenience sampling was performed for 3 months, from April to June 2018. The inclusion criteria were participants who were the primary family caregivers, were children or spouses, were ≥ 20 years old, were living with older adults with DM, and were responsible for caring for older adults as caregivers. We defined older adults as those who were ≥ 60 years old because many studies have adapted this age^{34, 35, 36}). Exclusion criteria were family caregiver with DM and who were unable to answer the self-reported sheet.

The nurses employed at the abovementioned hospital were trained to assess participant candidates and provided study information. These nurses assessed the participants based on the inclusion and exclusion

criteria and then introduced the eligible participants to the researcher. A total of 161 eligible participants were recruited from 200 older adults with DM by selecting one patient–one participant approach. A researcher thoroughly explained the study information to all eligible participants. We obtained formal consent from all eligible participants before conducting a face-to-face interview. Subsequently, 151 participants responded, obtaining a response rate of 93.8% (Figure 2).

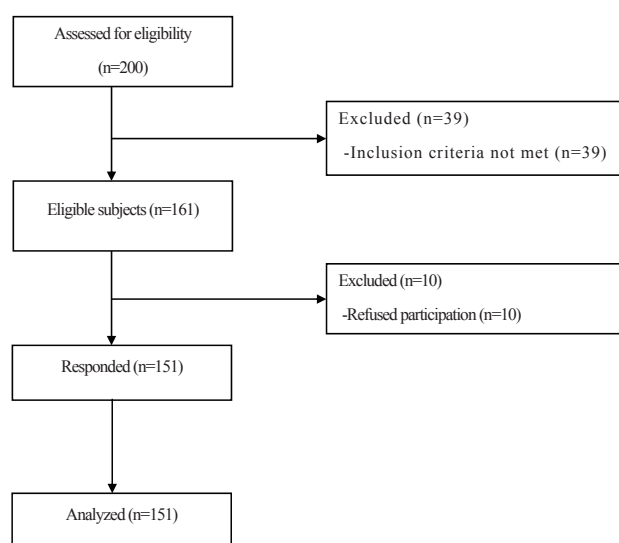


Fig 2: Flow diagram of the subjects

3. Measurements

1) Characteristics of older adults with DM

Characteristics of older adults included demographic information such as age, sex, educational status, working status, insurance status, DM duration, hospitalization frequency in the previous year, and hospitalization length.

The independent status of older adults has an influence on the caregiver burden¹⁴. Barthel index (BI) contains 10 items that examine patient's ability with regard to self-care in ADLs. These 10 items include feeding, bathing, grooming, dressing, transferring, toilet use, stair climbing, controlling bowel, controlling bladder, and mobility. Raw 10 BI scores can range from 0–100; higher scores reflect minor activity limitations. A total score of 100 presents the highest level of dependence with Cronbach's alpha = .93³⁷.

2) Characteristics of family caregivers

Characteristics of family caregivers comprised demographic information such as age, sex, educational status, marital status, working status, chronic illness

status, relationship to the patient, years as a caregiver, and the number of hours of caring for older adults.

To measure the caregiver's DM knowledge, we used the 24-item version of the Diabetes Knowledge Question, which has a reliability coefficient of 0.78. The items were scored with 1 point for a correct answer and 0 point for an incorrect answer or unknown. The total score ranges from 0 to 24 points. A high score indicated a high DM knowledge³⁸. The scale was forward- and back-translated by the Foreign Language Department- Hai Phong University of Medicine and Pharmacy. In this study, the reliability of this scale was calculated to be a Cronbach's alpha value of .76.

To measure the self-efficacy of a family caregiver, we employed the Revised Scale for Caregiving Self-efficacy. This 15-item scale assesses caregivers' belief about their own ability to complete caregiving activities. The score ranged from 0 (cannot do it at all) to 100 (certain can do it); a higher score indicated higher confidence in completing caregiving activities. Participants responded to three subscales such as obtaining self-care, responding to disruptive patient behavior, and controlling upsetting thoughts, with Cronbach's alpha of .86, .79, and .82, respectively³⁹.

To examine the caregivers' behavior toward DM support, we used the Diabetes Caregiver Activity and Support Scale (D-CASS) that includes 11 items. This scale was valid and reliable for measuring the extent of difficulty or ease of caregiving activities and supportive behaviors for their family caregivers of patients with DM. The items of this scale were rated on a range of -3 (extremely difficult) to +3 (extremely easy); low total scores indicate more difficulty in performing caregiving activities. The internal consistency was calculated according to the Cronbach's alpha of .82²⁶.

To measure caregiver burden, we employed the Zarit Burden Interview (ZBI) comprising 22 items scored on a 5-point scale ranging from 0 to 4, sequentially corresponding to "never," "rarely," "sometimes," "often," and "always." The total scores ranged from 0 to 88, with 0 indicating minimum burden and 88 indicating maximum burden. A higher score indicated more severe caregiver burden. The ZBI scale was reliable, with a Cronbach's alpha of .93⁴⁰. This scale is widely used for family caregivers of people with dementia, heart failure, lung cancer, and so on. In this study, the

Cronbach's alpha score of the scale that was used for family caregivers of older adults with DM was 0.94.

3) Characteristics of social support

We determined the social support using variables such as the caregiving education received from professional health staff, the family type, and the number of family members as caregivers.

4. Data analysis

Data were analyzed using the IBM SPSS Statistics version 21 and IBM SPSS-Amos version 21. Preliminarily, we examined the frequency by descriptive statistic. The normality of variable distribution was assessed using the Kolmogorov–Smirnov statistic with a significance level of $p < .05$. For abnormal variable distribution, we used the Mann–Whitney or Kruskal–Wallis tests with one-way ANOVA to explore the different significance levels between the variables and the caregiver burden. Thereafter, we selected the appropriate variables according to multicollinearity before performing a linear regression, which was then used to predict the factor variables of caregiver burden. Finally, the goodness-of-fit information for the overall model was obtained using pathway analysis, which indicated the structural relationships among the investigated variables. Consistency of pathway analysis with structural equation modeling (SEM) was interpreted using the comparative fit index (CFI), goodness-of-fit index (GFI), standardized root mean square residual (SRMR), and root mean square errors of approximation (RMSEA)⁴¹.

We divided variables into groups based on former studies^{34,35,36}. We chose high school to divide education levels into two groups according to the national education system in Vietnam⁴². The low educational group comprised those who studied till high school. The high education group included those who had attended college and had an undergraduate, masters, or doctorate degree. The number of hours of caring for older adults was divided into three groups based on the regulations of national labor law⁴³, which states no more than 8 hours for daily work per day and no more than 12 hours for total hours of daily and-extra work per day. Years as caregiver and DM duration of the older adults were divided according to a previous study. The variables including length of stay in hospital, older adult ADLs abilities, DKQ, self-efficacy, and caregiver

behavior toward DM care support were all abnormally distributed using the median point as the cutoff point for dividing the groups for each variable.

Ethical consideration

This study was approved by the Medical Ethics Committee of Kanazawa University (approval No.832-1), dated on March 15, 2018. We obtained approval from the managing board of Viet Tiep General Hospital and obtained the informed consent of all the participants. This study complies with Helsinki Declaration (2013.10, World Medical Association), and ethical guidelines for research on medical science for people (Ministry of Education, Culture, Sports, Science and Technology, Ministry of Health, Labor and Welfare, December 22, 2014).

Results

1. Preliminary analysis

The characteristics of family caregivers are presented in Table 1. Of 151 family caregivers (25.8% male, 74.2% female), 101 (66.9%) was aged <60 years, and their mean (standard deviation, SD) was 52.9 (12.4), ranging from 24 to 85 years. Most caregivers were married (136, 90.1%) and had low educational status (111, 73.5%). Moreover, 94 (62.3%) family caregivers were employed, 47 (31.1%) had a chronic illness, and 136 (90.1%) had caregiving experience of ≤ 5 years. Moreover, 72.2% of the family caregivers reported a high number of hours of caring for their older adult patients, spending at least 8 h per day. Additionally, 92 (60.9%) of them exhibited minimal DM knowledge. Significant differences were observed between caregiver burden and their characteristics of age ($p < .001$), educational status ($p = .013$), working status ($p = .023$), chronic illness status ($p = .002$), relationship to older adults ($p = .007$), the number of hours of caring for older adults ($p < .001$), self-efficacy ($p = .003$), and behavior toward DM care support ($p < .001$). The mean (SD) score of ZBI of the low-score group in D-CASS was 42.7 (12.9), whereas it was 29.1 (13.0) in the high group, indicating the low-score group of D-CASS showed ten score higher than the high-score group.

Table 2 shows that most of the older adults (64.2%) were aged ≥ 70 years, and their mean age (SD) was 73.7 (8.8), ranging from 60 to 95 years. More than

Table 1: Characteristic of family caregivers with burden

| Variables | Total | | ZBI | p-value |
|---|------------|------------|-----|---|
| | n(%) | Mean (SD) | | |
| n=151 | | | | |
| Age | | | | |
| < 60 | 101 (66.9) | 33.5(13.7) | | |
| ≥60 | 50(33.1) | 42.6(14.7) | | < .001 ^f |
| Sex | | | | |
| Male | 39(25.8) | 34.5(13.1) | | |
| Female | 112(74.2) | 37.2(15.2) | | 0.458 ^f |
| Education level | | | | |
| Low | 111(73.5) | 38.2(15.0) | | |
| High | 40(26.5) | 31.7(12.6) | | 0.013 ^f |
| Marital status | | | | |
| Single | 12(7.9) | 42.6(19.4) | | |
| Married | 136(90.1) | 35.8(14.3) | | |
| Widow | 3(2.0) | 44.0(3.0) | | 0.303 ^f |
| Working status | | | | |
| Not working | 57(37.7) | 40.3(16.6) | | |
| Working | 94(62.3) | 34.2(12.9) | | 0.023 ^f |
| Caregiver with chronic illness status | | | | |
| No | 104(68.9) | 33.5(12.6) | | |
| Yes | 47(31.1) | 43.1(16.8) | | 0.002 ^f |
| Relationship to patient | | | | |
| Spouse | 53(35.1) | 40.4(14.1) | | |
| Child | 98(64.9) | 34.3(14.6) | | 0.007 ^f |
| Number of hours as responsible for older adults | | | | |
| < 8 hours | 42(27.8) | 27.8(9.5) | | |
| 8-12 hours | 41(27.2) | 35.5(14.3) | | |
| >12 hours | 68(45.0) | 42.4(14.6) | | < .001 ^f < 8 hours <> 12 hours ^g 8-12 hours <> 12 hours ^g |
| Years as a caregiver | | | | |
| ≤ 5 years | 136(90.1) | 36.5(14.6) | | |
| 6 - 10 years | 13(8.6) | 37.1(15.8) | | |
| ≥ 11 years | 2(1.3) | 32.0(16.9) | | 0.783 ^f |
| DKQ | | | | |
| Low DKQ | 92(60.9) | 38.3(15.4) | | |
| High DKQ | 59(39.1) | 33.7(13.1) | | 0.073 ^f |
| Self-efficacy | | | | |
| Low SE | 76(50.3) | 40.2(15.1) | | |
| High SE | 75(49.7) | 32.7(13.3) | | 0.003 ^f |
| Caregiver behavior toward DM care support | | | | |
| Low | 82(54.3) | 42.7(12.9) | | |
| High | 69(45.7) | 29.1(13.0) | | < .001 ^f |

^f Kruskal Wallis test
^g Mann Whitney U test
^h Pairwise comparison by Kruskal Wallis one-way ANOVA
 ZBI; Zarit Burden Interview Scale
 DKQ; Diabetes Knowledge Questions
 SE; self-efficacy
 DM; diabetes mellitus

half of them were female (79, 52.3%) and most were currently unemployed (143, 94.7%). Furthermore, 63 (41.7%) of the older adults had DM for ≥10 years, and approximately half of them (67, 44.4%) were being hospitalized at least twice per year. Regarding the characteristics of older adults with DM, DM duration of the older adults and caregiver burden were significantly different (p = .002).

Regarding social support, a high proportion of family caregivers responded that they did not receive caregiving education from professional health staff (116, 76.8%). An extended family was the most prevalent family type observed (93, 61.6%). In addition, 82 (54.3%) families had ≤2 family members as caregivers. The caregiver burden showed a significant difference in terms of factors such as the acquisition of caregiving education (p = .006) and the number of family

Table 2: Characteristic of older adults with burden

| Variables | Total | | ZBI | P-value |
|--|-----------|------------|-----|---|
| | n(%) | Mean (SD) | | |
| n=151 | | | | |
| Age | | | | |
| 60-69 | 54(35.8) | 37.8(13.2) | | |
| 70-79 | 54(35.8) | 34.6(15.2) | | |
| 80-89 | 37(24.5) | 37.8(14.9) | | |
| ≥90 | 6(4.0) | 34.2(17.4) | | 0.428 ^f |
| Sex | | | | |
| Male | 72(47.7) | 36.6(13.0) | | |
| Female | 79(52.3) | 36.4(16.1) | | 0.642 ^f |
| Education level | | | | |
| Low | 135(89.4) | 37.3(14.8) | | |
| High | 16(10.6) | 29.8(10.9) | | 0.095 ^f |
| Working status | | | | |
| Not working | 143(94.7) | 36.6(14.5) | | |
| Working | 8(53.0) | 33.7(11.9) | | 0.485 ^f |
| Insurance status | | | | |
| No | 11(7.3) | 39.5(14.3) | | |
| Yes | 140(92.7) | 36.2(14.7) | | 0.505 ^f |
| Duration DM of older adults | | | | |
| ≤ 5 years | 57(37.7) | 41.2(14.6) | | |
| 6 - 9 years | 31(20.5) | 32.2(13.7) | | |
| ≥ 10 years | 63(41.7) | 33.8(13.8) | | 0.002 ^f ≤ 5 years > 6- 9 years ^g ≤ 5 years > ≥ 10 years ^g |
| Number of hospitalizations / last year | | | | |
| < 2 times | 84(55.6) | 35.4(15.8) | | |
| ≥ 2 times | 67(44.4) | 37.9(13.1) | | 0.137 ^f |
| Length of stay in hospital | | | | |
| < 12 days | 95(62.9) | 37.1(14.7) | | |
| ≥ 12 days | 56(37.1) | 35.5(14.7) | | 0.512 ^f |
| Older adult ADLs abilities | | | | |
| Low ADLs | 83(55.0) | 37.6(14.7) | | |
| High ADLs | 68(45.0) | 35.1(14.6) | | 0.238 ^f |

^f Kruskal Wallis test
^g Mann Whitney U test
^h Pairwise comparison by Kruskal Wallis one-way ANOVA
 ZBI; Zarit Burden Interview scale
 ADLs; activities Daily Living
 DM; diabetes mellitus

Table 3: Characteristic of social supports with burden

| Variables | Total | | ZBI | P-value |
|--|-----------|------------|-----|---------------------|
| | n(%) | Mean (SD) | | |
| n=151 | | | | |
| Received caregiving education. | | | | |
| No | 116(76.8) | 38.2(14.7) | | |
| Yes | 35(23.2) | 30.6(12.8) | | 0.006 ^f |
| Type of family | | | | |
| Extended | 93(61.6) | 35.9(14.8) | | |
| Nuclear | 58(38.4) | 37.5(14.4) | | 0.837 ^f |
| Number of family members as caregivers | | | | |
| ≤ 2 | 82(54.3) | 40.5(15.1) | | |
| > 2 | 69(45.7) | 31.7(12.7) | | < .001 ^f |

^f Mann Whitney U test
 ZBI; Zarit Burden Interview scale

members as caregivers (p < .001) (Table 3).

2. Linear regression analysis

Overall, 11 independent significant variables associated with caregiver burden (Tables 1–3) were obtained based on the appropriate multicollinearity, with a VIF ≤10, or tolerance ≥ .10 (Table 4); all these variables were included in this model. The result of

Table 4. Multicollinearity among the variables

| Variables | Tolerance | VIF |
|--|-----------|------|
| Duration DM of older adults | 0.71 | 1.41 |
| Age of caregivers | 0.41 | 2.46 |
| Education level of caregivers | 0.87 | 1.15 |
| Working status | 0.65 | 1.53 |
| Caregiver with chronic illness status | 0.85 | 1.18 |
| Relationship to patient | 0.47 | 2.13 |
| Number of family members as caregivers | 0.49 | 2.02 |
| Number of hours of caring for older adults | 0.73 | 1.37 |
| Received caregiving education | 0.75 | 1.33 |
| Self-efficacy | 0.83 | 1.20 |
| Caregiver behavior toward diabetes support | 0.69 | 1.45 |

DM; diabetes mellitus
VIF; variance inflation factor

Table 5. Factors of care burden by Linear Regression analyses

| Variables | B | SE | β | t |
|--|------------------|------|---------|----------|
| Duration DM of older adults | -0.25 | 0.15 | -0.13 | -1.72 |
| Age of caregivers | 4.86 | 3.05 | 0.16 | 1.59 |
| Education level of caregivers | -3.66 | 2.22 | -0.11 | -1.65 |
| Working status | -2.11 | 2.33 | -0.07 | -0.91 |
| Caregiver with chronic illness status | 6.38 | 2.14 | 0.20 | 2.97** |
| Relationship to patient | 4.51 | 2.79 | 0.15 | 1.62 |
| Number of family members as caregivers | 0.08 | 0.91 | 0.01 | 0.09 |
| Number of hours of caring for older adults | 2.67 | 1.28 | 0.15 | 2.08* |
| Received caregiving education | -1.79 | 2.49 | -0.05 | -0.72 |
| Self-efficacy | -0.01 | 0.01 | -0.16 | -2.37* |
| Caregiver behavior toward DM care support | -0.83 | 0.16 | -0.39 | -5.20*** |
| R ² | 0.45 | | | |
| AdjR ² | 0.41 | | | |
| F(p) | 10.395 (p<0.001) | | | |

*p<.05 **p<.01 ***p<.001
SE; Standardized Error
 β ; β Standardized Coefficients
DM; diabetes mellitus

linear regression analysis showed that the regression model for caregiver burden was significant ($F = 10.395$, $p < .001$, $AdjR^2 = .41$). Therefore, caregivers with chronic illness status ($\beta = .20$), the number of hours of caring for older adults ($\beta = .15$), self-efficacy ($\beta = -.16$), and caregiver behavior toward DM care support ($\beta = -.39$) were all significant factors of caregiving burden (Table 5).

3. Pathway analysis

For testing the hypothesis, the characteristics of older adults and social support, which were not related to caregiver burden, were included in this model (Tables

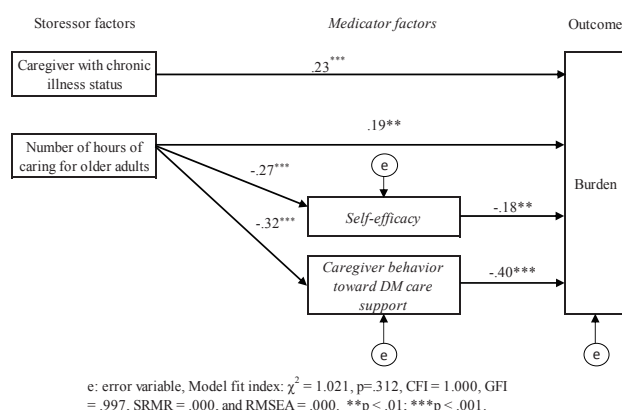


Figure 3: Pathway diagram for burden.

1–3,5). In the model, the characteristics of family caregiver such as chronic illness status ($\beta = .23$, $p < .001$), the number of hours of caring for older adults ($\beta = .19$, $p = .006$), self-efficacy ($\beta = -.18$, $p = .005$), and caregiver behavior toward DM care support ($\beta = -.40$, $p < .001$) were significant direct predictors of caregiver burden. Interestingly, the association between the number hours of caring for older adults and caregiver burden was mediated by caregiver self-efficacy ($\beta = -.27$, $p < .001$) and caregiver behavior toward DM support ($\beta = -.32$, $p < .001$) (Figure 3).

Using the goodness-of-fit model, we examined the relationship between the factors and caregiver burden. The results showed that the model fit statistic obtained the following values: $\chi^2 = 1.021$, $df = 1$, and $p = .312$. Moreover, the analysis statistic presented the following: CFI = 1.000, GFI = .997, SRMR = .000, and RMSEA = .000.

Discussion

1. Family caregivers with chronic illness and higher number of hours of caring for older adults as direct factors of caregiver burden

We found that family caregivers with chronic illness status might be one of the major factors contributing to caregiver burden. Family caregivers with chronic illness have to take care of themselves as well as of older adults with DM. Therefore, these family caregivers do not have enough time for self-care, resulting in psychological and physical distress. In fact, low self-care among family caregivers was associated with psychological distress, such as depression, and anxiety⁴⁴. Regarding this aspect, Orem (2011)⁴⁵ stated that self-care can maintain a balance between activities

and rest, thus helping in maintaining individual well-being. Also, aging further contributes to psychological as well as physical distress, since there was a significant difference between the ZBI score of those aged <60 and ≥ 60 years in this study. It has also been shown that caregivers aged ≥ 60 years contributed to high caregiver burden⁴⁶⁾. This suggests that nursing practice should assess the health status and should support implementation on self-care of caregiver, especially in aging population.

This study indicated that the number of hours of caring for older adults was the other major risk of caregiver burden. Goldsworthy (2008)⁴⁷⁾ stated that insufficient respite time increases caregiver burden. This study revealed that most family caregivers spent ≥ 8 h to provide care. Such long duration caregiving hours cause fatigue to the caregiver, resulting in burden. We considered two reasons for interpreting why the family caregivers need to spend many hours to care for older adults. Although we did not explore amputation rate, amputation (39%)⁴⁸⁾ is a serious disability and complication of DM, adding to the load of caregiver assistance for these individuals, such as assistance for transferring, moving, and toileting. Older adults with DM need to avoid having further complication from aging syndrome, declining muscle strength, as well as DM. To avoid these complications, family caregivers need to have knowledge regarding techniques for assisting in ADLs and caring diabetes. The other reason for burden is inadequate support in daily life environments, such as lack of handrails for walking, which makes assistance of older adults difficult for family caregivers. Bonnefoy (2007)⁴⁹⁾ demonstrated that most older adults have insufficient home environment. A quasi-experimental study indicated that modification of home environment could increase self-care in older adult by themselves⁵⁰⁾. Therefore, the number of hours of caring for older adults might reduce as older adults can perform their ADLs by themselves. Nurses should give advice to improve home environments, such as the use of handrails, nonslip carpets, and appropriate light in home. This intervention will have a couple of effects, such as encouraging self-care in older adults and reducing load on family caregivers.

2. The influence of number of hours of caring for the older adults on caregiver burden via self-efficacy and caregiver behavior toward DM care support as mediator factors

This study found that the number of hours of caring for older adults with DM has an influence on self-efficacy among family caregivers. We considered two reasons for this finding. First, Bandura (1997)²⁹⁾ stated that the family has a substantial resource effect on self-efficacy. Similarly, Yi Liu & Hua Huang (2016)⁵¹⁾ pointed out that the lack of family support for caregiver indicated less caregiver self-efficacy. In this study, although an extended family was the most prevalent family type, the number of family members acting as caregivers was ≤ 2 . Therefore, family caregivers find it difficult to seek help from other family members, resulting a low self-efficacy. It should be considered as an improvement in family function to focus on sharing the caregiving role among family members. Second, the family caregivers, who take care for older adults with ≤ 5 years of DM duration, have a higher burden than others, indicating that these family caregivers have a lack of knowledge regarding caregiving skills for ADLs support. Bandura (1997)²⁹⁾ stated that the low self-efficacy among caregivers is due to the lack of personal experiences. Similarly, a previous study supported that the caregivers do not have the appropriate skills and knowledge to provide care for patient with illness, so they lack confidence (self-efficacy) and feel unprepared⁵²⁾. Thus, family caregivers need adequate understanding of caregiving experiences to improve their confidence in handling older adults without feeling threatened.

Similarly, the number of hours of caring for older adults affected caregiver behavior toward DM care support in this study. The family caregivers take care of older adults for long duration hours without support from others and knowledge, resulting in low caregiver behavior DM care support. In fact, social support is one of the elements that can help family caregivers have private time to relax, take care of own their health when they provide care⁵³⁾. Moreover, the family caregivers showed a lack of DM knowledge, since 76.8% of the family caregivers responded to not having caregiving education. The limitation of DM knowledge causes more difficulties especially when the

family caregivers perform activities regarding DM care. A previous study pointed that the family caregivers who received nursing skill training would be better in providing care as well as controlling the burden⁵⁴). In addition, psychological support has also been indicated to be useful for behavior and depression management⁵⁵). For these reasons, we considered that nurses should provide an intervention with triple aspects including providing DM knowledge, training diabetes activities support, and supporting for reducing psychological distress. This can improve the caregiver behavior DM care support.

The present study revealed that the mediator factors including self-efficacy and caregiver behavior toward DM care support had an impact on caregiver burden. To begin with self-efficacy, a literature review suggested that intervention with coping strategies may be useful in controlling depression, anxiety, and burden among caregivers⁵⁶). According to cognitive appraisal of transactional theory of stress and coping, self-efficacy as a personal coping resource could enhance individual abilities of overcoming distress²⁵). Self-efficacy is an individual's belief in his or her abilities to perform their role³²), and it also reduces negative mood and increases positive mood⁵⁷) when they cope with threatening situations while providing care to older adults, resulting in overcoming caregiver burden. Another previous study confirmed that self-efficacy helps individual improve coping with distress and overcome it⁵⁸). Durmaz (2014)⁵⁹) also revealed a negative correlation between caregivers' self-efficacy and their burden. It helps an assertion for this finding that over a half of the family caregivers have low self-efficacy, buffering a high risk of caregiver burden in this study. Turning to the other aspect, caregiver behavior toward DM care support is related to caregiving activities and support such as medication adherence, preventing and managing diabetes complications, glucose control, meal preparation, emotional support²⁶). Lazarus and Folkman (1984)²⁵) and Scarton et al. (2017)²⁶) also supported that this caregiver behavior factor can affect the coping abilities of family caregivers, thereby reducing their distress. This coping ability deserves an attribution from learning how to cope with distress, such as finding appropriate knowledge to coping, handling their distress, dealing with older adult behavior, seeking emotional support,

finding appropriate resource support. Li et al. (2014)⁶⁰) pointed out the family caregivers who received a coping strategies intervention had less caregiver distress. In sum, the caregivers coping skills should be considered for nursing assessment of caregivers to control burden. The caregiver self-efficacy and behavior toward DM care support regarding handling with distress and finding knowledge could be considered as elements of nursing assessment for caregiver coping skill.

Limitations

The present study has several limitations that should be acknowledged. Convenience sampling was applied, and the participants were selected from one hospital of one area, thereby limiting the generalization of the study. Furthermore, the cross-sectional design resulted in difficulty in causal interpretation. The face-to-face interview method in this study may have resulted in the Hawthorne effect. Uncollected data such as of HbA1c, blood sugar value, medications, insulin injection, complications might relate to caregiver burden.

Conclusion

This study provided an insight into the factors of caregiver burden based on a development model. In short, family caregivers with chronic illness was a direct factor of caregiver burden; whereas number of hours of caring for older adults was a direct and indirect factor of caregiver burden through self-efficacy and caregiver behavior toward DM care support as mediator factors. This study suggested that nurses should assess the family caregivers' health status and support to improve their self-care. Furthermore, a nursing intervention should consider perception of self-efficacy with respect to DM knowledge, DM care knowledge, and training diabetes care activities to support to help reduce the risks of caregiver burden.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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開発モデルにおける糖尿病高齢患者の家族介護者の介護負担要因の検討

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要 旨

本研究は、理論的に開発したモデルに基づき、糖尿病の高齢者とその家族介護者の特徴、介護自己効力、および糖尿病支援と社会的支援に向けた介護者の行動における、糖尿病の高齢者の家族介護者の介護負担要因を検討することを目的とした。研究デザインは横断調査研究であり、主家族介護者を対象に無記名構成的質問紙を用いて個別にインタビューし、データを収集した。対象者の66.9%は60歳未満であり、74.2%は女性であった。線形回帰分析では、家族介護者が慢性疾患をもっていること ($\beta=.20$)、高齢者への介護時間数 ($\beta=.15$)、介護自己効力 ($\beta=-.16$)、糖尿病支援と社会的支援に向けた介護者の行動 ($\beta=-.39$) が介護負担に係わる要因であった ($F=10.395, p<0.001, AdjR^2=.41$)。パス解析では、家族介護者が慢性疾患をもっていることが直接的に介護負担につながっていた。そして、高齢者への介護時間数は直接的に介護負担に係わっているのみならず、介護自己効力と糖尿病支援と社会的支援に向けた介護者の行動を介して間接的に介護負担につながっていた ($\chi^2=1.021, p=.312, CFI=1.000, GFI=.997, SRMR=.000, RMSEA=.000$)。介護負担の軽減には、介護者の特徴と介護への責任について検討する必要がある。家族機能への看護介入方法を探すこと、社会的支援を探すこと、自身のセルフケアを行う時間が増えること、介護に関する知識と技術をもつことが介護負担の軽減につながると示唆された。