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ORIGINAL RESEARCH

# Mediating the Role of Perceived Social Support Between Frailty and Self-Perceived Burden in Elderly Patients with Diabetes

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**Objective:** To explore the mediating effects of perceived social support between frailty and self-perceived burden (SPB) in elderly patients with diabetes and to provide a theoretical basis for reducing that burden.

**Methods:** A total of 169 elderly patients with diabetes who were hospitalised in the endocrinology department of a third-class hospital in Wuxi between May 2020 and July 2022 were included in this study using the convenience sampling method. Patients were assessed by the general information questionnaire, the Chinese version of the Tilburg frailty inventory (TFI), the Self-Perceived Burden Scale (SPBS) and the Perceived Social Support Scale (PSSS). The SPSS 22.0 software was used for Pearson's correlation analysis and multiple linear regression analysis. Model four of the SPSS PROCESS was used for mediating the effect analysis.

**Results:** The SPBS of elderly patients with diabetes was positively correlated with the TFI ( $P < 0.01$ ) and negatively correlated with the PSSS ( $P < 0.01$ ). The results of the Bootstrap test showed that the mediating effect of the PSSS on the relationship between the TFI and the SPBS in elderly patients with diabetes was 0.296 (95% CI: 0.007, 0.066), and the mesomorphic effect accounted for 17.3% of the total effect.

**Conclusion:** The debilitation of elderly patients with diabetes can be reduced by decreasing their SPB through perceived social support. This can be achieved through comprehensive interventions by nurses.

**Keywords:** elderly patients with diabetes, frailty, self-perceived burden, mediating effects

## Introduction

Featuring a long course of disease, diabetes is a risk factor for multiple chronic diseases and may result in a variety of complications.<sup>1</sup> Controlling diabetes is influenced by several factors, such as medication, follow-up management and emotional and social support, as physiological and social functions have a serious negative impact on the mental states of patients with diabetes.<sup>2</sup> Self-perceived burden (SPB) refers to negative emotions such as anxiety, depression and loneliness, which are caused by physical worries about the illness and psychological stress that encompasses feelings of guilt, dependence and fear of imposing a burden on others during the care-receiving process.<sup>3</sup> Recent studies<sup>4</sup> have shown that the frailty arising from chronic diseases among elderly patients is in close connection with SPB. Frailty is a senile syndrome mainly characterised by decreased physiological reserve function, multiple organ dysfunction, increased organismal vulnerability and declining anti-stress ability.<sup>5</sup> Hyperglycaemia, multiple complications and defects in islet function<sup>6</sup> increase the frailty of hospitalised elderly patients with diabetes. The disease progression further restrains their self-care ability and mobility. Their role change in their families and society hinders their recovery and worsens their SPB, which, in turn, further enhances their frailty, causing a vicious cycle. Therefore, it is crucial to remedy the frailty of elderly patients with diabetes to relieve their SPB. Current intervention studies on



frailty are weighted in external behaviours, including physical exercise, medication and cognitive training.<sup>7</sup> Little emphasis is placed on the subjective perspective of patients, namely, their effective psychological response to their illness and condition.

According to Roy's Adaptation Model,<sup>8</sup> a person is a bio–psycho–social being in constant interaction with a changing environment in which perception and emotions are important psychological adaptation mechanisms. Perceived social support (PSS) is the individual's subjective experience of being supported, respected and understood. It is an effective way to gain positive emotions and assistance, and it plays an important role in psychological responses.<sup>9</sup> The changes in physiological function affect a person's perceptions, experiences and adaptation levels, which means that frailty levels may also influence PSS. Therefore, this study made the hypothesis that PSS is correlated with frailty and SPB. The mediating factors of PSS were analysed to provide practical enlightenment for alleviating SPB among elderly patients with diabetes.

## Methods

### Objectives

A total of 169 elderly patients with diabetes who were hospitalised in the endocrinology department of a Grade-A hospital in Wuxi between May 2020 and July 2022 were included in this study. The inclusion criteria were as follows: (1) aged  $\geq 60$ , according to the United Nations' definition for elderly people; (2) diagnosed with diabetes;<sup>10</sup> (3) did not have mental illnesses or cognitive impairment; (4) were partially self-reliant or completely unable to take care of themselves; (5) voluntarily signed the informed consent form. The exclusion criteria were as follows: (1) were in critical condition and unable to cooperate during this study; (2) were unable to communicate normally. This study was approved by the Ethics Committee of our hospital (No. KY23160). Written informed consent was obtained from all participants or their legal representatives.

According to Kendall's Tau,<sup>11</sup> the sample size should be 5–10 times the number of variables. Considering the invalid sample size, the sample size was increased by 20%, with at least 78–156 candidates.

### Applied Tools

#### 1. General information questionnaire:

The general information questionnaire covered entries such as age, gender, education, medical expenses, living status, primary caregivers, etc.

#### 2. Tilburg frailty indicator:

Localised by Zamora-Sánchez et al,<sup>12</sup> the Tilburg frailty indicator (TFI) involved 15 entries concerning physical, psychological and social frailty, and the binary “yes or no” scoring system was applied. Scores equal to or higher than five points were defined as frailty, and the higher the score was, the more severe the frailty degree was. Cronbach's alpha coefficient was 0.73.

#### 3. Self-Perceived Burden Scale:

Introduced by Saji et al,<sup>13</sup> the Self-Perceived Burden Scale (SPBS) featured 10 entries from 3 dimensions: economic, physical and emotional burdens, and the five-point Likert scale was applied. According to their scores, the patients were classified as having no SPB when they had a score of 10–19 points, having a light SPB when they had a score of 20–29 points, having a moderate SPB when they had a score of 30–39 points and as having a heavy SPB when they had a score of 40–50 points. Cronbach's alpha coefficient was 0.9.

#### 4. Perceived Social Support Scale:

Modified by Lin et al,<sup>14</sup> the Perceived Social Support Scale (PSSS) included 12 items in 3 dimensions: family support (4 items), friend support (4 items) and social support (4 items). Each item was scored on a scale of 1–7, with a total score of 12–84 points. Cronbach's alpha coefficient for each dimension and total dimensions were 0.82, 0.83, 0.79 and 0.90, respectively.

### Quality Control

Unified training for the investigators was conducted prior to the study. Before the survey, the purpose of the questionnaire was disclosed to the patients, and informed consent was provided by them. During the survey, the patients were encouraged to fill in the questionnaire independently, and standard guidance language was adopted for any questions. After completion, the

questionnaires were collected immediately and checked for any errors or missing information, which were confirmed with the respondents and then corrected to ensure quality.

## Statistical methods

The EpiData3.1 software was used for data entry, and the SPSS 22.0 software was used for statistical analysis. The measurement data applied the mean  $\pm$  standard deviation, and the enumeration data adopted the number of cases and percentages. To evaluate the relationship between SPB, frailty and PSS, Pearson's correlation and multiple linear regression were used for correlation analysis and multiple linear regression analysis, respectively. The mediating effect was tested using the SPSS PROCESS Macro (Model 4), and a value of  $P < 0.05$  was considered statistically significant. To avoid homological errors, the Harman single-factor test was used to assess common method bias.<sup>15</sup>

## Results

### General Information

A total of 176 questionnaires were sent out, 170 were collected and 169 were deemed valid, with an effective return rate of 96.1%. The patients had an average age of  $75.74 \pm 6.10$  years old, comprising 101 men and 68 women (Table 1).

**Table I** General Information of Survey Subjects (n=169)

Variables	Group	Number of Cases (Percentage, %)
Gender	Male	101 (59.76)
	Female	68 (40.24)
Age	65–74 years old	79 (46.75)
	≥75 years old	90 (53.25)
Marital status	In marriage	140 (82.84)
	Unmarried, divorced, widowed	29 (17.16)
Education level	Primary school and below	70 (41.42)
	Junior high school	51 (30.18)
	High school/technical secondary school	25 (14.79)
	College degree or above	23 (13.61)
Residential situation	Living Alone	21 (12.43)
	Live with spouse only	116 (68.64)
	Live with children only	13 (7.69)
	Living with spouse and children	19 (11.24)
Monthly income level	<3500 yuan	47 (27.81)
	3500–6000 yuan	52 (30.77)
	6001–8000 yuan	47 (27.81)
	>8000 yuan	23 (13.61)
Payment form of medical expenses	Self funded	3 (1.78)
	Resident medical insurance	96 (56.80)
	Rural medical insurance	65 (38.46)
	Public healthcare	5 (2.96)
Primary caregivers	Spouse	132 (78.11)
	Children	33 (19.53)
	Other	4 (2.37)
Course of disease	<5 years	23 (13.61)
	5–9 years	18 (10.65)
	10–20 years	65 (38.46)
	>20 years	63 (37.28)

(Continued)

**Table 1** (Continued).

Variables	Group	Number of Cases (Percentage, %)
Number of comorbidities	None	0 (0.00)
	1–2 types	79 (46.75)
	≥3 types	90 (53.25)
Number of complications	None	1 (0.59)
	1–2 types	111 (65.68)
	≥3 types	57 (33.73)

## Scores of the Tilburg Frailty Indicator, Self-Perceived Burden Scale and Perceived Social Support Scale in Elderly Patients with Diabetes

The total score of the TFI was  $7.34 \pm 2.13$  points, and the scores in each dimension were as follows: physical frailty,  $4.54 \pm 1.40$  points; psychological frailty,  $2.21 \pm 1.00$  points; social frailty,  $0.60 \pm 2.13$  points. The total score of the SPBS was  $30.22 \pm 7.00$  points, and the scores in each dimension were as follows: physical burden,  $15.44 \pm 4.85$  points; emotional burden,  $11.46 \pm 4.11$  points; economic burden,  $3.30 \pm 1.27$  points. The total score of the PSSS was  $54.94 \pm 12.63$ , and the scores in each dimension were as follows: family support,  $23.00 \pm 4.71$  points; friend support,  $16.73 \pm 4.99$  points; other support,  $15.18 \pm 5.58$  points.

## The Correlation of Self-Perceived Burden, Frailty and Perceived Social Support in Elderly Patients with Diabetes

Pearson's correlation analysis showed that frailty was positively correlated with SPB ( $r = 0.388, P < 0.01$ ) and negatively correlated with PSS ( $r = -0.393, P < 0.01$ ), and PSS was negatively correlated with SPB ( $r = -0.297, P < 0.01$ ) (Table 2).

## Multiple Linear Regression Analysis of Self-Perceived Burden, Frailty and Perceived Social Support in Elderly Patients with Diabetes

Controlling for potential variables, this study conducted multiple linear regression with the SPBS as the dependent variable. The independent variables included the total statistically significant scores from the TFI and the PSSS, as determined through correlation analysis. The results show that the TFI can positively predict the value of the SPBS and that the PSSS can positively predict the value of the SPBS (Table 3).

## The Mediating Effect Analysis of Perceived Social Support

The results showed that there were three factors with characteristic roots  $>1$ , and the total variation explained by the first factor was 37.21%, which was lower than the 40% critical standard, indicating no serious common method bias.

**Table 2** The Correlation Between Self Perceived Burden and Weakness, Perceived Social Support

Project		Weak	Self-Feeling	Understand Social Support
Weak	<i>r</i>		0.388	-0.393
	<i>P</i>		<0.01	<0.01
Self-feeling	<i>r</i>	0.388		-0.297
	<i>P</i>	<0.01		<0.01
Understand social support	<i>r</i>	-0.393	-0.297	
	<i>P</i>	<0.01	<0.01	

**Table 3** Multivariate Linear Regression Analysis of Senile Diabetes Weakness, Self Perceived Burden and Perceived Social Support

Argument	Non-Standard Coefficient	Standard Error	Standardization Coefficient	t value	P value
Constant	26.789	4.738	—	5.654	0.000
Weak	1.413	0.337	0.321	4.188	0.000
Understand social support	-0.127	0.057	-0.171	-2.230	0.027

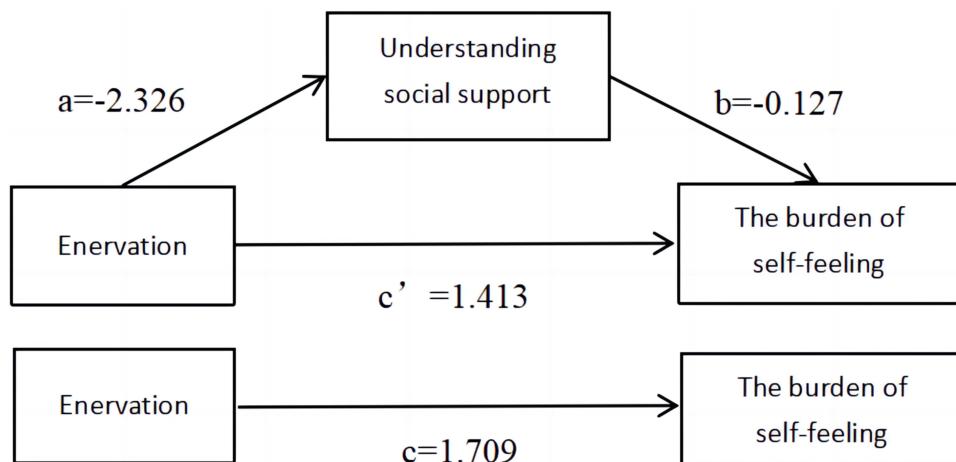
**Table 4** Analysis of the Mediating Effect of Social Support Between Frailty and Self Perceived Burden

Effect		Coeff	SE	t	P	LLCI	ULCI
Direct effect	Weak self-feeling burden	1.413	0.337	4.189	0.000	0.747	2.079
Indigo effect	Debility understanding social support	-2.326	0.421	-5.520	0.023	-3.158	-1.494
Gross effect	Understand the social support of self-feeling burden	-0.127	0.057	-2.230	0.027	-0.240	-0.015
	Weak self-feeling burden	1.709	0.314	5.442	0.000	1.089	2.328

The SPSS PROCESS Macro (Model 4) was used to test the mediating effect, with the frailty of elderly patients with diabetes as the independent variable, PSS as the mediating variable and SPB as the dependent variable. The results indicated that frailty could predict PSS ( $a = -2.326$ , standard error (SE) = 0.421,  $P < 0.05$ ). The regression analysis of frailty and PSS was conducted, and the results showed that frailty could predict SPB ( $c' = 1.413$ , SE = 0.337,  $P < 0.05$ ) and that PSS could predict SPB ( $b = -0.127$ , SE = 0.057,  $P < 0.05$ ). The bias-corrected percentile Bootstrap test indicated a significant mediating effect of PSS on frailty and SPB, with an indirect effect (ab) of 0.296, a Bootstrap SE of 0.163 and a 95% confidence interval of (0.007, 0.066). The mediating effect accounted for  $ab/(ab + c') = 17.3\%$  of the total effect, indicating that PSS played a partial mediating role between frailty and SPB (Table 4 and Figure 1).

## Discussion

This study analysed the relationship between frailty, SPB and PSS in elderly patients with diabetes, and the results showed that significant pairwise correlations were found among the three factors. Frailty was significantly correlated with SPB ( $r = 0.388$ ,  $P < 0.01$ ), and its generating mechanism was related to physical, psychological and social frailty. Social



**Figure 1** Diagram of the Mediating Effect of Social Support between Frailty and Self-Perceived Burden.

**Notes:** (a) is the effect of Enervation acting on the Understanding social support. (b) is the effect of Understanding social support acting on The burden of self-feeling c'means after controlling for the mediation effect, the effect of Enervation acting on the The burden of self-feeling. (c) stands for the total effect of the independent variable Enervation acting on the dependent variable The burden of self-feeling.

frailty refers to low levels of important social resources, social activities and self-management ability to meet basic social needs. It is a key factor accelerating declines in physical and mental functions. Increasing evidence shows that social frailty has serious consequences for the physical, psychological and spiritual health of elderly patients with diabetes.<sup>16</sup> All factors interact with and influence each other. Elderly patients suffering from severe social and psychological frailty often experience more serious physical frailty, which has always been the focus of research on the ageing population problem. This interconnectedness inevitably leads to SPB, where psychological frailty plays a direct role in its manifestation. When physical and psychological frailty were controlled, social frailty was still significantly related to SPB.<sup>17</sup> Because social frailty is a dynamic process, slowing it down is an important method of alleviating the SPB of elderly patients with diabetes, raising their quality of life and realising a proactive response to ageing.

This study revealed a close relationship between frailty and PSS ( $r = -0.393, P < 0.01$ ). The more severe the frailty was, the lower the PSS level was. Moreover, PSS remains an important way for elderly patients with diabetes to relieve pressure, gain support and experience positive emotions, which originate from individual cognitive functions.<sup>18–20</sup> Diabetes affects neurocognitive areas such as attention, memory, executive ability, mobility and processing ability.<sup>21</sup> Patients with diabetes deal with their frailty through common perceptions and past experiences, which create cognitive biases, hindered perceived ability and lowered perception of social support. Consequently, different measures should be taken, such as conducting disease–health education to change patients' perceptions of their condition, which is a critical approach to enhancing PSS.

In addition, this study indicated that the lower the PSS level was, the heavier the SPB was ( $r = -0.297, P < 0.01$ ), which was consistent with the research results of Du et al.<sup>22</sup> This suggests that the capacity for social cognition, encompassing the ability to contemplate one's own and others' mental states for understanding and predicting behaviours, is also deemed a significant predictor of mental health.<sup>23</sup> According to sociological theories, people interact with each other through certain expectations, and when their expectations for themselves, other people and the context they are in cannot be met during the interaction, one or more negative emotions arise. Such negative emotions can further grow and eventually produce adverse consequences<sup>24</sup> if the interactors cannot obtain support and affirmation from others in time. Self-satisfaction and affirmation for elderly patients with diabetes are effective ways to alleviate their SPB. Narrations of similar stories and the learning and experiencing processes can allow the patients to find their strengths, exercise physiological functions,<sup>25,26</sup> raise their living standards and self-management ability and reduce SPB.

This study revealed that the SPB of elderly patients with diabetes and frailty was affected by their PSS. The frailty level of the patients could directly predict their levels of SPB as well as indirectly affect it via PSS. A high level of PSS meant wider acceptance and recognition by others, bringing in a better self-image. Image maintenance could encourage patients to show higher self-confidence when dealing with their condition and life events. It could allow them to better handle depression, anxiety and other emotions caused by physical, psychological and social frailty.<sup>4</sup> If an elderly patient who suffers from high physical frailty due to diabetes remains in a state of stress and seldom receives social support from family, friends and society, they will be unwilling to communicate with others, raising their SPB level. Hence, it is imperative not only to secure the material foundation but also to empower individuals to exercise subjective initiative in alleviating (SPB).

## Limitations

This study had several limitations due to the COVID-19 pandemic, quarantine measures, social distancing and other factors arising thereof. Furthermore, most of the patients were urban residents, which means that the results may not reflect patients living in the countryside. Therefore, a wider pool of participants is needed for future studies.

## Conclusions

Perceived social support plays a mediating role in the direct correlation between frailty and SPB in elderly patients with diabetes. The results provide a new practical perspective for exploring the influencing mechanism between frailty and SPB in those patients.

## Implications

When formulating intervention plans and strategies, medical personnel should take a comprehensive consideration of the special needs of elderly patients, and they should encourage their families and society to participate in raising their PSS.

Moreover, medical personnel should encourage elderly patients with diabetes to actively participate in disease self-management to reduce their SPB.

## Data Sharing Statement

All data generated or analyzed during this study are included in this article.

## Ethics Approval and Consent to Participate

This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Nanjing Medical University. Written informed consent was obtained from all participants.

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## Disclosure

Ming-Zhu Chen and Xiao-Lei Chen are co-first authors for this study. Qin Xu and Xiao-Dong Cao are co-correspondence authors for this study. The authors declare no conflicts of interest in this work.

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