

**The mediating role of sleep quality on well-being among Japanese working family caregivers**

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**Short running title:** Sleep and well-being in caregivers

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**Abstract**

The purpose of this study was to investigate whether the well-being of caregivers is mediated by the association between behavioral and psychological symptoms in elderly relatives and the quality of sleep experienced by caregivers using a mediational model. The participants were 105 working family caregivers in Japan. We assessed well-being based on the Kessler Scale-10, self-rated health, and satisfaction in daily life. Our results showed that the well-being in working family caregivers was impacted by the severity of behavioral and psychological symptoms in elderly relatives. Well-being in working family caregivers was also affected by quality of sleep. Maintaining good quality of sleep in working family caregivers is important for reducing caregiver burden and psychological distress, and for improving the balance between work and family life.

**Keywords:** Well-being, Working family caregivers, Quality of sleep, Mediational model, Psychological distress, Self-rated health, Japan

## **Introduction**

Caregiving has a profound impact on a caregiver's personal time and work life. In a previous study,<sup>1</sup> more than half (53%) of caregivers reported losing income and personal time because of the demands of care provision, and 46% of caregivers reported that providing care had adversely affected their personal health and well-being. In Japan, the number of workers who leave work to care for elderly relatives has increased. For example, in 2007, a total of 88,000 workers retired to care for elderly relatives.<sup>2</sup> Additionally, about 70% of Japanese family caregivers experienced negative feelings such as stress or distress,<sup>3</sup> and one in four family caregivers has been depressed.<sup>4</sup> Honda et al.<sup>5</sup> reported several risk factors for poor mental health among caregivers, including financial and psychological burdens, lack of sleep and free time owing to caregiving, and caring for persons with behavioral problems. They also reported that caregivers of elderly persons with behavioral problems were significantly more likely to have poor mental health than caregivers of persons without behavioral problems.<sup>5</sup> It has been widely recognized that many caregivers of dementia patients have sleep problems, and that these sleep problems are frequently related to the nighttime behaviors of the care recipients.<sup>6, 7</sup> In addition, those studies have found that approximately two-thirds of caregivers suffer from sleep disturbances, and that poor caregiver sleep is linked not

only to physical and psychological burdens, but also to an increased risk of depression and cardiovascular disease.<sup>6,7</sup>

According to a previous study, informal caregivers of elderly relatives experience lower subjective well-being than non-caregivers.<sup>8</sup> Moreover, recent studies have reported that caring for a person with dementia is associated with decreased mental health and subjective well-being.<sup>9, 10, 11, 12</sup> Well-being comprises diverse dimensions such as philosophical and psychiatric ideals. Ryff et al.<sup>13</sup> reported that psychological well-being had the following six core dimensions: self-acceptance; purpose in life; environmental mastery; personal growth; positive relationships with others; and autonomy. Keyes<sup>14, 15</sup> described mental health in terms of well-being, and considering health and happiness as scientific concepts has become one of the key factors in promoting satisfaction in daily life. Joseph et al.<sup>16</sup> presented a restricted view of well-being, seeing it as “an absence of distress and dysfunction.” They believed that this new measurement could better enable the prediction and treatment of distress and dysfunction.

Previous studies on the relationship between well-being and health in family caregivers have used two-valued logic,<sup>9, 17</sup> but it is unknown what role of sleep quality might play as an intervention in the promotion of well-being through reducing the

negative effects of behavioral and psychological symptoms in elderly relatives. We hypothesized that caregiver's well-being is mediated by the relationship between such behavioral and psychological symptoms in elderly relatives and the quality of sleep experienced by caregivers. Mediation is a process whereby something causes an event or condition, which in turn causes a third event.<sup>18</sup> The mediational model has been used in the field of psychology, and demonstrates that some factors appear to affect psychological condition has been able to analyzed by statistical modeling.<sup>19</sup> For example, caregiver burden may affect the quality of the caregiver-care recipient relationship, which in turn may influence the caregiver's perception of burden. Honda et al.<sup>5</sup> used a mediational model to identify the mechanism underlying the relationship between behavioral problems among the elderly and depression among caregivers. The purpose of this study was to investigate whether the well-being of caregivers is mediated by the association between behavioral and psychological symptoms in elderly relatives and the quality of sleep experienced by caregivers using a mediational model.

## **Methods**

### *Participants*

The study participants were working family caregivers of elderly relatives in Nagasaki Prefecture, Japan. All participants were administered questionnaires between December

2009 and February 2010. First, we received permission from the directors of all workplaces to conduct the survey, and then recruited employees to participate. Self-administered questionnaires were distributed to 844 employees, and 787 responses were received (response rate, 93.2%). Among these 787 employees, 119 were providing care to elderly relatives who lived with the caregiver or in either a nursing home or hospital. After excluding questionnaires with missing data for sex, age, self-rated health, satisfaction in daily life, and those who did not complete all questions of the Kessler Scale-10 (K10), a total of 105 participants (49 men and 56 women) were enrolled for analysis. A cover letter at the beginning of the questionnaire described the study, explained its purpose and ethical aspects, and requested respondents' voluntary participation. Agreement to complete and return the questionnaire was considered as consent given to participate in this study.

#### *Ethical approval*

Informed consent was obtained from all participants included in the study. This study was reviewed and approved by the institutional ethics committee of the Nagasaki University School of Medicine, Nagasaki, Japan, in October 2009.

#### *Measures*

Data were collected on care recipients, including age, sex, living arrangements, and

presence and types of behavioral and psychological symptoms. Working family caregiver demographics included age, sex, marital status, self-rated health and type of employment (full-time job, part-time job, and other job). With regard to employment status, the Japanese version of the National Institute for Occupational Safety and Health Generic Job Stress Questionnaire (NIOSH-GJSQ) was used to assess that job overload, job satisfaction, and support from supervisors and coworkers. The NIOSH-GJSQ, which was developed by Hurrell and colleagues in 1988 to measure job-related stress,<sup>20</sup> is widely used in the field of occupational health. The Japanese version of the NIOSH-GJSQ was developed by Haratani and colleagues in 1993,<sup>21</sup> and has shown acceptable reliability, with Cronbach's  $\alpha$  coefficients ranging from 0.68-0.95.<sup>22, 23, 24</sup> In the present study, job-related stress was defined based on the following three items: (1) job overload with dichotomous classification (i.e., low or high); (2) job satisfaction with dichotomous classification (i.e., satisfied or unsatisfied); (3) support from supervisors and coworkers using a Likert scale (i.e., a lot, some, a little or none). Questions on care-related social support included whether there was an informal supporter for caregiving, a place to receive consultation on caregiving, and a reliable source of information on care services.

*Assessment of mental health conditions using the K10 scale*

The K10 scale, which was developed by Kessler and colleagues,<sup>25</sup> was used to assess the mental health conditions of the participants.<sup>26</sup> The K10 scale was devised as a reliable self-rating scale to indicate how frequently participants had experienced psychological distress or negative feelings during the previous month using a 5-point Likert scale with the following responses: never (0), seldom (1), sometimes (2), often (3), and always (4). The total score on the K10 scale is the sum of all responses, and ranged from 0 to 40. Higher scores reflect more severe psychological distress, and a score of 15 or higher indicates increased risk for psychological distress.<sup>27</sup> The screening performance of the Japanese version of the K10 has been shown to be essentially equivalent to that of the original English version (Cronbach's  $\alpha = 0.91$ ).<sup>28</sup>

#### *Caregiver burden*

Caregiver burden was assessed using a total of five items divided into the following three indices with dichotomous answer (presence or absence): psychological burden (two items), physical burden (two items), and financial burden (one item). Psychological burden includes a lack of free time, severe stress, and a heavy psychological burden, while physical burden includes physical pain (e.g., back, knee, or shoulder pain) and fatigue.

#### *Behavioral and psychological symptoms*



The behavioral and psychological symptoms of the elderly care recipients were assessed using the following nine items with dichotomous answer (presence or absence): night wandering; hygiene problems; eating problems; uncooperative or oppositional behavior; aggression/violence; day/night rhythm disturbances; confabulation/visual hallucinations/auditory hallucinations; talking to oneself; and forgetting to turn off the gas range.

#### *Quality of sleep*

The following five types of insomnia have been identified: difficulty initiating sleep; early morning awakening; repeated nocturnal awakenings; difficulty getting back to sleep; and difficulty maintaining sleep. Quality of sleep is not determined solely by amount of sleep time, but rather differs among individuals.<sup>29</sup> Therefore, sleep quality was assessed according to the participants own self-rating as follows, regardless of sleep duration: good; intermediate; or poor.

#### *Subjective well-being*

Physical and psychological health conditions, and social activities are important element in well-being.<sup>6, 7</sup> In this study, well-being was defined by the following three health-related items: 1) self-rated health (good vs. intermediate, poor); 2) satisfaction in daily life (satisfied vs. intermediate, unsatisfied); and 3) mental health condition

(absence vs. presence of psychological distress). Participants who reported having good self-rated health, satisfaction in daily life, and no psychological distress were classified into a high well-being (HWB) group, while those who did not were classified into a low well-being (LWB) group.

#### *Data analysis*

The associations between well-being and characteristics of caregivers, caregiver burden, and behavioral and psychological symptoms of the elderly relatives were analyzed. The chi-square test was used for nominal scale data such as caregiver burden, and behavioral and psychological symptoms, whereas the Wilcoxon rank-sum test was used for ordinal scale data such as number of caregiver burdens.

Furthermore, we focused on whether the quality of sleep mediated the association between well-being and behavioral and psychological symptoms. The three-step Baron and Kenny framework was used to identify the underlying mechanism of these three variables.<sup>30</sup> In the first step, a simple regression analysis established that the number of behavioral and psychological symptoms was predictive of the mediator, i.e., the quality of sleep. In step 2, logistic regression analysis established that the number of behavioral and psychological symptoms was predictive of well-being. Finally, the inclusion of sleep quality in step 3 established that this factor mediated the predictive relationship

between the number of behavioral and psychological symptoms and the well-being. These associations represent a mediator model with the number of behavioral and psychological symptoms as the independent variable, the quality of sleep as the mediator variable, and the well-being as the dependent variable, as shown in Figure 1 and Table 5.

## **Results**

### *Characteristics of participants*

Table 1 summarizes the characteristics of participants and care recipients. The mean age  $\pm$  standard deviation (SD) of caregivers was  $46.3 \pm 10.7$  years (age range, 21- 64 years). Twenty-six of the caregivers were living with their care recipients. The mean duration of caregiving was 3.64 years. The mean age ( $\pm$  SD) of the 105 care recipients was  $82.1 \pm 6.5$  (age range, 65-100 years). Approximately 70% of the care recipients were women.

Table 2 shows the association between demographic characteristics, social support, and degree of well-being among caregivers. Quality of sleep was significantly associated with well-being ( $p < 0.001$ ). No significant differences were found between the HWB and LWB groups in age, sex, marital status, or in type of employment ( $p = 0.515$ ) or job overload ( $p = 0.157$ ); however, the proportion of caregivers who felt dissatisfied at their

work was overwhelmingly lower in the HWB workers than in the LWB workers (11.1% vs. 88.9%, respectively;  $p = 0.024$ ). In addition, no significant differences were found between groups in regard to care-related information or social support.

Table 3 summarizes the association between caregiver burden and degree of well-being in caregivers. In total, 42 caregivers (40%) had caregiver burdens, and approximately half of the caregivers reported experiencing “severe stress and heavy psychological burden”. No significant differences were found between the HWB and LWB groups in the number of caregiver burdens ( $p = 0.156$ ).

Table 4 summarizes the association between behavioral and psychological symptoms in elderly relatives and degree of well-being in caregivers. In total, 32 participants (30.5%) were providing care to an elderly relative with behavioral and psychological symptoms. The proportion of elderly relatives with behavioral and psychological symptoms was significantly lower in the HWB than in the LWB group ( $p = 0.04$ ).

Table 5 shows the results of the hypothesized mediational model with behavioral and psychological symptoms, quality of sleep, and well-being. The results from step 1 show that the number of behavioral and psychological symptoms experienced by the care recipients was significantly associated with quality of sleep as the mediator variable (regression coefficient = 0.219;  $p = 0.028$ ). The results from step 2 show that the

number of behavioral and psychological symptoms was also significantly associated with well-being as the dependent variable (regression coefficient = -0.502;  $p = 0.034$ ).

The results from step 3 show that no significant association was found between the number of behavioral and psychological symptoms among the care recipients and the proportion of caregivers with a high well-being (regression coefficient = -0.371;  $p = 0.145$ ), whereas a significant association was found between quality of sleep and the proportion of caregivers with a high well-being (regression coefficient = -1.111;  $p = 0.001$ ). Therefore, the regression coefficient for the number of behavioral and psychological symptoms among the care recipients decreased from 0.502 to 0.371.

## **Discussion**

In Japanese society, working family caregivers have begun to address psychological distress from the two dimensions of work-related stress and emotional disturbances caused by care demands. In Japan, the population of elderly requiring care owing to being bedridden or having cognitive impairment has increased dramatically. In recent years, faced with increasing numbers of Long-Term Care Insurance (LTCI) users and ever-growing expenditures on care for the elderly, the Japanese government has pressed to formulate sustainable long-term care policies with an emphasis on community-based rather than nursing home services. As the number of workers whose elderly relatives

require care continues to increase, a concomitant need to identify ways of preventing psychological distress and improve well-being among working family caregivers is apparent. The concept of well-being has given rise to blurred and overly broad definitions, and this issue remains largely unresolved. In this study, we defined high levels of well-being as conditions that promote good emotional and self-rated health and feelings of satisfaction in daily life among caregivers, despite the demands of juggling work and caregiving.

The purpose of this study was to investigate whether the well-being of caregivers is mediated by the association between behavioral and psychological symptoms in elderly relatives and the quality of sleep experienced by caregivers using a mediational model. Möller-Leimkühler and Mädger<sup>31</sup> used a mediational model to identify an underlying mechanism in the relationship between personality factors and psychological well-being among caregivers. They reported that psychological well-being was mediated by the amount of subjective burden, which differs from our results. The result of the present study suggest that well-being among caregivers is affected by the amount of behavioral and psychological symptoms experienced by their elderly relatives. A reason for this may be that participants who were employed in the labor force spent the majority of their days at work, and may therefore have spent less time on caregiving and provided

less care than did non-employed counterparts. By contrast, non-employed caregivers may be more heavily immersed in caregiving and relatively more committed to care than their employed counterparts.<sup>32</sup> We argue that subjective caregiver burdens and mental health conditions affected by behavioral and psychological symptoms in elderly relatives cannot be separated. Therefore, the influence of caregiving on well-being is not unitary; conversely, different numbers and combinations of psychological burdens may contribute to well-being, and stressors may be compounded depending on the caregiving situation. In caregiver research, most studies have found that caring for elderly people with dementia is associated with increased caregiver burden and decreased well-being.<sup>33,34</sup> However, the scope of these studies was limited to the effects of individual personality and life-stress factors on the possibility of recovery from heavy psychological distress. The present study suggests that the degree of individual well-being among caregivers is affected by the quality of their sleep. The psychological distress of caregivers, in the context of behavioral and psychological symptoms of elderly relatives, is based on “difficulty communicating with care recipient”. If caregivers can maintain a high quality of sleep to improve psychological distress and caregiver burdens, this will improve not only positive control of life and health, but also overall well-being.

Although no association was found between type of employment and well-being in the present study, the degree of job satisfaction impacted the degree of well-being among caregivers. Prior studies have shown that part-time workers experience job insecurity and have an increased risk of depression,<sup>35</sup> and that the vast majority of part-time workers are women.<sup>36</sup> Most married Japanese women who work part-time have husbands who are the primary breadwinners and have the responsibility of supporting the dependent family members. Such primary breadwinners can receive a family allowance (money provided for the purpose of supporting your family) from their company as well as a tax exemption for dependents from the Japanese government. Most married women who work part-time prefer to keep their annual income within the limits of the exemption for dependents. In fact, “living as one’s husband’s dependent” is one of the most popular reasons for working part-time in Japan.<sup>37</sup> Therefore, low income and job insecurity may not necessarily affect psychological distress among women working part-time if they are supported economically by their husbands. Seto et al.<sup>38</sup> investigated the work and family life of women in Japan and found that full-time employees were more likely than part-time employees to report job pressures and experience work- and family-related stress. Consequently, we believe that having a part-time job may contribute to life and/or job satisfaction because of the improved



balance between work and family life among women.

In addition, in the present study, no association was found between care-related support and well-being among caregivers. In the case of caring for elderly with low levels of disability, the expectation of help from others may be absent, which would explain the lack of an association. Social support can be broadly characterized as either instrumental or emotional support. Instrumental support includes help with housework or assistance in caring for elderly,<sup>39</sup> while emotional support includes the supportive roles of religion and spiritual beliefs.<sup>40</sup> One of the biggest roles played by instrumental support is to directly reduce the physical burden of caregivers through the use of care service staff or informal care supporters who perform elderly caregiving on behalf of the caregivers. Caregivers incur only a small financial burden for the instrumental support of formal care service providers, and the subjective satisfaction derived from the reduction in physical burdens and/or gains in peace of mind through emotional support exceeds the cost of care service. Providing a combination of instrumental and emotional support may enhance satisfaction with social support and potentially help promote well-being.

Our study had several limitations. First, because the number of participants was limited, we could not include details related to the caring situation in our analysis.

Second, the study did not use any standardized scales for caregiver burdens or behavioral and psychological symptoms; therefore, scores may not reflect comprehensive care-related stress factors. Finally, the results may be subject to a “healthy worker effect.” If more distressed working caregivers were more likely to quit their jobs, then those left to participate in our study would, on the whole, be less distressed. The strengths of this study were twofold. First, we found that the sleep quality of caregivers actually mediates the effects of behavioral and psychological symptoms in care recipients on the caregiver’s well-being. Second, our study used the mediational model, which has rarely been utilized, to focus on the promotion of well-being among working family caregivers.

### **Conclusion**

In summary, our findings suggest that the degree of sleep quality affects well-being in working family caregivers, which is known to have a controlling effect on behavioral and psychological symptoms among elderly relatives. It is therefore important for working family caregivers to maintain high-quality sleep in order to reduce caregiver frustration and improve the balance between work and family life in home care.

### **Acknowledgments**

We are grateful to all participants for their valuable contributions to this study.

### **Declaration of Conflicting Interests**

The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### **Funding**

The author(s) discloses receipt of the following financial support for the research, authorship, and/or publication of this article: This publication was made possible by the Yuumi Memorial Foundation for Home Health Care.

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### Figure legend

Figure 1. Mediation model with the number of behavioral and psychological symptoms as the independent variable, quality of sleep as the mediator variable, and well-being as the dependent variable.

Table 1. Characteristics of working family caregivers and care recipients

Characteristics	Care recipient (n = 105)	Caregiver (n = 105)
	N (%)	N (%)
Sex		
Male	32 (30.5)	49 (46.7)
Female	73 (69.5)	56 (53.3)
Age (y)		
Mean age (SD)	82.1 (6.51)	46.3 (10.66)
Age range	65-100	21-64
Relationship with caregiver		
Son		41 (39.0)
Daughter		22 (21.0)
Daughter-in-law		16 (15.2)
Son-in-law		4 (3.8)
Wife		1 (1.0)
Husband		0 (0)
Other		21 (20.0)
Living arrangement		
With caregiver	26 (24.8)	
With own family	40 (38.1)	
In a nursing home/care facility/hospital	37 (35.2)	
Other	2 (1.9)	
Mean duration of caregiving (y)		3.64

Table 2. Association between demographic characteristics, social support, and degree of well-being among caregivers

Characteristics of caregivers	Well-being			p value <sup>a</sup>
	High (n = 49)	Low (n = 56)	Number (%)	
	N (%)	N (%)		
Age in years	Mean (SD)	47.4 (10.3)	45.4 (11.0)	0.356 <sup>a</sup>
Sex				
	Male	24 (49)	25 (51)	49 (46.7)
	Female	25 (44.6)	31 (55.4)	56 (53.3)
Marital status				
	Married	38 (51.4)	36 (48.6)	74 (70.5)
	Never married	10 (45.5)	12 (54.5)	22 (21)
	Divorced, separated, widowed	1 (14.3)	6 (85.7)	7 (6.7)
	Unknown	0 (0)	2 (100)	2 (1.9)
Quality of sleep				
	Good	25 (64.1)	14 (35.9)	39 (37.1)
	Intermediate	20 (46.5)	23 (53.5)	43 (41)
	Poor	4 (17.4)	19 (82.6)	23 (21.9)
Type of employment				
	Full-time	36 (43.9)	46 (56.1)	82 (78.1)
	Part-time	8 (53.3)	7 (46.7)	15 (14.3)
	Other	5 (62.5)	3 (37.5)	8 (7.6)
Job overload				
	Low	25 (54.3)	21 (45.7)	46 (43.8)
	High	23 (40.4)	34 (59.6)	57 (54.3)
	Unknown	1 (50)	1 (50)	2 (1.9)
Job satisfaction				
	Satisfied	48 (50.5)	47 (49.5)	95 (90.5)
	Unsatisfied	1 (11.1)	8 (88.9)	9 (8.6)
	Unknown	0 (0)	1 (100)	1 (1)
Receive support from supervisor and coworkers				
	A lot	8 (53.3)	7 (46.7)	15 (14.3)
	Some	18 (60)	12 (40)	30 (28.6)
	A little	23 (44.2)	29 (55.8)	52 (50)
	None	0 (0)	5 (100)	5 (4.8)
	Unknown	0 (0)	3 (100)	3 (2.9)
Informal supporter for caregiving				

	Yes	45 (48.4)	48 (51.6)	93 (88.6)	
	No	1 (14.3)	6 (85.7)	7 (6.7)	0.081 <sup>b</sup>
	Unknown	3 (60)	2 (40)	5 (4.8)	
Sufficient information on care services					
	Yes	44 (46.3)	51 (53.7)	95 (90.5)	
	No	3 (42.9)	4 (57.1)	7 (6.7)	0.859 <sup>b</sup>
	Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
Present of place for consulting on caregiving					
	Yes	47 (47)	53 (53)	100 (95.2)	
	No	0 (0)	2 (100)	2 (1.9)	0.187 <sup>b</sup>
	Unknown	2 (66.7)	1 (33.3)	3 (2.9)	

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<sup>a</sup> t test

<sup>b</sup> Chi-square test excluding Unknown category

<sup>c</sup> Cochran-Armitage test excluding Unknown category

SD, standard deviation.

Table 3. Association between caregiver burden and degree of well-being in caregivers

Variables	Well-being		Number (%)	p value <sup>a</sup>
	High (n = 49)	Low (n = 56)		
	N (%)	N (%)		
<i>Psychological burden</i>				
Severe stress and heavy psychological burden				
Yes	10 (43.5)	13 (56.5)	23 (21.9)	0.776 <sup>a</sup>
No	37 (46.8)	42 (53.2)	79 (75.2)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
Lack of free time				
Yes	7 (43.8)	9 (56.3)	16 (15.2)	0.839 <sup>a</sup>
No	40 (46.5)	46 (53.5)	86 (81.9)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
<i>Physical burden</i>				
Physical pain				
Yes	1 (25)	3 (75)	4 (3.8)	0.388 <sup>a</sup>
No	46 (46.9)	52 (53.1)	98 (93.3)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
Fatigue				
Yes	1 (16.7)	5 (83.3)	6 (5.7)	0.136 <sup>a</sup>
No	46 (47.9)	50 (52.1)	96 (91.4)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
<i>Financial burden</i>				
Heavy financial burden				
Yes	2 (22.2)	7 (77.8)	9 (8.6)	0.133 <sup>a</sup>
No	45 (48.4)	48 (51.6)	93 (88.6)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
Number of caregiver burdens				
0	31 (51.7)	29 (48.3)	60 (57.1)	0.156 <sup>b</sup>
1	11 (36.7)	19 (63.3)	30 (28.6)	
2	5 (62.5)	3 (37.5)	8 (7.6)	
3	0 (0)	4 (100)	4 (3.8)	
Unknown	2 (66.7)	1 (33.3)	3 (2.9)	
Median (1st quartile, 3rd quartile)				
	0 (0,1)	0 (0,1)		0.151 <sup>c</sup>

<sup>a</sup> Chi-square test excluding Unknown category

<sup>b</sup> Cochran-Armitage test excluding Unknown category

<sup>c</sup> Wilcoxon rank-sum test excluding Unknown category

Table 4. Association between behavioral and psychological symptoms in elderly relatives and degree of well-being in caregivers

Variables	Well-being			p value <sup>a</sup>
	High (n = 49)	Low (n = 56)	Number (%)	
	N (%)	N (%)		
Night wandering				
Yes	2 (28.6)	5 (71.4)	7 (6.7)	0.339 <sup>a</sup>
No	43 (47.3)	48 (52.7)	91 (86.7)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Hygiene problems				
Yes	3 (42.9)	4 (57.1)	7 (6.7)	0.866 <sup>a</sup>
No	42 (46.2)	49 (53.8)	91 (86.7)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Eating problems				
Yes	0 (0)	3 (100)	3 (2.9)	0.105 <sup>a</sup>
No	45 (47.4)	50 (52.6)	95 (90.5)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Uncooperative or oppositional behavior				
Yes	1 (16.7)	5 (83.3)	6 (5.7)	0.138 <sup>a</sup>
No	44 (47.8)	48 (52.2)	92 (87.6)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Aggression/ violence				
Yes	1 (12.5)	7 (87.5)	8 (7.6)	0.048 <sup>a</sup>
No	44 (48.9)	46 (51.1)	90 (85.7)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Day/ night rhythm disturbances				
Yes	0 (0)	5 (100)	5 (4.8)	0.034 <sup>a</sup>
No	45 (48.4)	48 (51.6)	93 (88.6)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Confabulation/ visual hallucinations/ auditory hallucinations				
Yes	4 (28.6)	10 (71.4)	14 (13.3)	0.159 <sup>a</sup>
No	41 (48.8)	43 (51.2)	84 (80)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Talking to oneself				
Yes	4 (57.1)	3 (42.9)	7 (6.7)	0.536 <sup>a</sup>
No	41 (45.1)	50 (54.9)	91 (86.7)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
Forgetting to turn off the gas range				
Yes	3 (33.3)	6 (66.7)	9 (8.6)	0.427 <sup>a</sup>
No	42 (47.2)	47 (52.8)	89 (84.8)	
Unknown	4 (57.1)	3 (42.9)	7 (6.7)	

Number of behavioral and psychological symptoms



	0	35 (53)	31 (47)	66 (62.9)	
	1	4 (33.3)	8 (66.7)	12 (11.4)	
	2	5 (35.7)	9 (64.3)	14 (13.3)	0.04 <sup>b</sup>
	3 or more	1 (16.7)	5 (83.3)	6 (5.7)	
	Unknown	4 (57.1)	3 (42.9)	7 (6.7)	
<hr/>					
	Median (1st quartile, 3rd quartile)				
		0 (0,0)	0 (0,2)		0.028 <sup>c</sup>
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<sup>a</sup> Chi-square test excluding Unknown category

<sup>b</sup> Cochran-Armitage test excluding Unknown category

<sup>c</sup> Wilcoxon rank-sum test excluding Unknown category

Table 5. Mediation model with behavioral and psychological symptoms, quality of sleep, and well-being

	Items	Regression coefficient	Standard error	p value
Step 1				
Independent variable	Behavioral and psychological symptoms	0.174	0.078	0.028
Mediator variable	Quality of sleep			
Step 2				
Dependent variable	Well-being	-0.502	0.237	0.034
Independent variable	Behavioral and psychological symptoms			
Step 3				
Dependent variable	Well-being	-0.371	0.255	0.145
Independent variable	Behavioral and psychological symptoms			
Mediator variable	Quality of sleep			

Figure 1.

