

ORIGINAL ARTICLE

FACTORS INFLUENCING CAREGIVER'S SLEEP TIME AND THE DIFFERENCE BETWEEN THE EXPECTED AND ACTUAL AMOUNT OF CARE PROVIDED BY FAMILY CAREGIVERS AFTER HOSPITALIZATION IN THE CONVALESCENT WARD

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Abstract The purpose of this study was to clarify the factors influencing caregiver burden 1 month after hospitalized in the convalescent ward by investigating the difference between the expected and actual amount of care provided by family caregivers.

Thirty-one pairs of care receivers and caregivers were participated in this study. Multiple regression analysis was performed with J-ZBI_8, an examination which the burden of caregiving as dependent variable and information obtained from care recipients and caregivers as independent variables. As a result, the average value of J-ZBI_8 was 6.5 ± 5.3 points. 61% of the family caregivers' actual care was harder than they predicted before discharge. Results showed that the difference between the expected and actual amount of care provided by family caregivers ($\beta=0.471$, $P=0.002$), and caregivers' hours of sleep per day ($\beta=0.404$, $P=0.006$) were related to caregiver burden. In addition, the Functional Independence Measure items of memory, comprehension, social interaction and bowel management, and the frequency of hospital visits were factors relating with the difference between the expected and actual amount of care provided by family caregivers (adjusted $R^2=0.460$, $P=0.040$).

This research highlights the importance of how to handle symptoms and excretion due to dementia before discharge and increasing the frequency of hospital visits by caregivers, which might help to create a more realistic image of caregiving after hospitalization, thereby reducing caregivers' burden.

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Key words: Caregivers' burden; Convalescent Ward; Caregivers' sleep time; Family support.

Introduction

It is desired that rehabilitation medicine integrally offers medical care, prognoses, and life support. Providing care receivers' family with support to reduce caregivers' burden allows care receivers to live at home longer. However, current rehabilitation medicine does not place enough emphasis on supporting the family to avoid caregivers' burden during and after hospitalization.

Niina et al.¹⁾ advocated the stress model of

caregivers of elderly patients with dementia as a theoretical model of the causes and strategies of caregiver burden. This model uses various aspects of caregiving and the characteristics of care receivers as potential stressors. When a stressor is evaluated negatively, it implies that caregivers are placed under some degree of physical and psychological stress; therefore, methods of coping with the stressor and the related stress are required.

In the convalescent ward, caregivers can gain an understanding of the care receivers'

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activities of daily living (ADL) and potential stressors, such as problematic behavior due to dementia and rehabilitation, before the patient discharged. Based on the patient's information, the rehabilitation team judges whether home care is appropriate for the care receiver or not. The convalescent ward was possible to predict potential stressors after hospitalization and assess the caregivers' burden in advance.

If this hypothesis holds true, it is important not only to pay attention to care receivers' potential stressors before discharge, but also the difference between the expected and actual amount of care provided by family caregivers. If we can clarify the difference, we might be able to advise caregivers on how to provide care even in cases where the patient requires much care. Furthermore, with more concrete and realistic images of caregiving, caregivers might be able to decrease their burden and allowing care receivers to live at home longer.

The purpose of this study was to clarify the factors influencing caregiver burden 1 month after hospitalized in the convalescent ward by investigating the difference between the expected and actual amount of care provided by family caregivers.

All authors have no conflicts of interest directly relevant to the content of this article.

Methods

Subjects

We targeted patients who were discharged from our convalescent ward between June 2015 and February 2017 and their families. The following exclusion criteria were applied: 1) the patient did not live in his/her house after hospitalization, 2) the patient lived alone after hospitalization, 3) the patient or his/her family did not live in their house within 1 month after hospitalization, and 4) patients who had already experienced care before. 31 pairs of patient-

care giver who meet the above conditions were participated. This study was under the approval of (Nishibori Hospital) and Hirosaki University ethics committee.

Assessment

The care receivers' age, sex and care frequency were recorded. We evaluated ADL using the Functional Independence Measure (FIM). FIM evaluates 18 items in two subscales (FIM motor and FIM cognition) for daily life on a 7-point scale with a total score range of 18 to 126. Higher scores indicate a higher degree of independence. We also taken the information of caregivers' age, sex and relationship to the care receiver through verbal interviews conducted at the caregivers' homes. Caregiver burden was assessed using the short version of the Japanese version of the Zarit Caregiver Burden Interview (J-ZBI_8)^{2,3)}. The reliability and validity of the original Japanese version of the Zarit Caregiver Burden Interview (J-ZBI)⁴⁾ and the J-ZBI_8 were validated by Arai et al. The J-ZBI_8 has eight items whereas the original J-ZBI has 22 items; the J-ZBI_8 is, therefore, more practical than the J-ZBI and was chosen for this study.

The following question was asked to verify the hypothesis that whether the caregiver appropriately predicted the amount of care before discharge in order to lesser the occurrence of burden of care after discharge from the hospital. "Is the actual amount of care you provide different from what you expected?" The caregivers answered on a 4-point scale (1. much easier, 2. slightly easier, 3. slightly harder, and 4. much harder).

Caregivers were asked about hours of they sleep per day, hours they spend caregiving per day, frequency of hospital visits per week and frequency of rehabilitation observation per week.

Analysis

First, we conducted multiple regression anal-

ysis using the step-wise method with caregiver burden (i.e., J-ZBI_8 score) as the dependent variable. Independent variables included demographic information about care receivers and caregivers, the difference between the expected and actual amount of care provided, caregiving hours, and caregivers' hours of sleep.

Second, the correlation between items selected by multiple regression analysis and all 18 items of the FIM, the frequency of hospital visits, and the frequency of rehabilitation observation was confirmed using Spearman's rank correlation coefficient.

Then, we set the items selected by multiple regression analysis as the dependent variable. In addition, we conducted multiple regression analysis with the step-wise method using items with a correlation coefficient over 0.2 as the independent variable based on Guildford's rule of thumb. Finally, we conducted multiple regression analysis with the step-wise method using only items in the FIM motor subscale as the independent variable to offer concrete advice about ADL to caregivers. We used IBM SPSS22.0 as the statistical software and regarded P values < 0.05 as significant.

Results

Thirty-one care receivers and 31 caregivers participated in this study. We targeted 20 patients with cerebrovascular disease and 11 patients with orthopedic disease.

Care receiver characteristics

The average age was 76.9 ± 10.4 years. 12 were male and 19 were female. Nursing care levels were as follows: 1 person was categorized as support need 1, 2 people were categorized as support need 2, 1 person was categorized as long-term care 1, 10 people were categorized as long-term care 2, 7 people were categorized as long-term care 3, 9 people were categorized as

Table 1. Care receiver characteristics

Variable	Total (N=31)
Age, (y)	76.9 \pm 10.4
Gender, (%)	Male: 39, Female: 61
Nursing care level, (%)	Support need 1: 3 Support need 2: 7 Long-term care 1: 3 Long-term care 2: 32 Long-term care 3: 23 Long-term care 4: 29 Long-term care 5: 3
FIM, (points)	105.9 \pm 19.3
FIM-Motor	73.8 \pm 17.7
FIM-Cognitive	32.1 \pm 3.7
Eating	6.8 \pm 0.5
Grooming	6.5 \pm 1.1
Bathing	4.7 \pm 1.7
Dressing, upper body	6.4 \pm 1.4
Dressing, lower body	5.8 \pm 2.1
Perineal care	5.8 \pm 2.0
Bladder management	5.8 \pm 2.0
Bowel management	5.1 \pm 2.2
Transfer, bed, wheelchair	6.4 \pm 1.4
Transfer, toilet	6.2 \pm 1.4
Transfer, tub or shower	4.7 \pm 2.3
Walking/Wheelchair	5.5 \pm 2.0
Stairs	3.7 \pm 2.5
Comprehension	6.8 \pm 0.5
Expression	6.7 \pm 0.8
Cooperation	6.4 \pm 1.1
Problem solving	6.4 \pm 1.0
Memory	5.7 \pm 1.5

Data are expressed as mean \pm standard deviation.
FIM: functional independence measure.

long-term care 4, and 1 person was categorized as long-term care 5. Long-term care 2-4 occupied 84% which intended that many care recipients who needed nursing care in their daily life. The characteristics of the care receivers are shown in Table 1.

Caregiver characteristics

The average age was 63.3 ± 14.8 years. 8 were male and 23 were female. Relationships to the care receiver were as follows: 8 were daughters-in-law, 8 were common-law wives, 6 were daughters, 6 were husbands, 2 were sons, and 1 was mother. The average J-ZBI_8 score was 6.5 ± 5.3 . Variations were not seen in the degree of burden feeling. For the question on

Table 2. Caregiver characteristics

Variable	Total (N=31)
Age, (y)	63.4 ± 14.8
Gender, (%)	Male: 26, Female: 74
Relationship, (%)	Daughter-in-law: 26 Daughter: 19 Wife: 26 Husband: 19 Son: 7 Mother: 3
J-ZBI_8, (points)	6.5 ± 5.3
Difference between expected and actual amount of care provided, (%)	Very hard: 13 Slightly hard: 48 Slightly easy: 23 Very easy: 16
Sleeping (hours/day)	5.6 ± 1.3
Frequency of visit, (times/week)	3.1 ± 1.2

Data are expressed as mean ± standard deviation. J-ZBI_8: The short version of the Japanese version of the Zarit Caregiver Burden Interview.

the difference between the expected and actual amount of care provided, five caregivers answered, “much easier,” seven answered “slightly easier,” 15 answered “slightly harder,” and four answered “much harder.” The majority of caregivers answered that the caregiving was slightly harder than they expected. The average amount of sleep was 5.6 ± 1.3 hours per day. The average frequency of hospital visits was 3.1 ± 1.2 per week. The characteristics of the caregivers are shown in Table 2.

Multiple regression analysis with J-ZBI_8 as the dependent variable

Multiple regression analysis found the following variables to be significant: the difference between the expected and actual amount of care provided by family caregivers ($\beta=0.471$, $P=0.002$), caregivers’ hours of sleep ($\beta=0.404$, $P=0.006$), and care receivers’ age ($\beta=0.258$, $P=0.043$) (adjusted $R^2=0.561$, $P=0.043$).

Relationship between caregivers’ hours of sleep and FIM items

The items with correlation coefficients over 0.200 were FIM bowel management, FIM problem solving, FIM bathing, FIM stairs, FIM

transfer to tub or shower, FIM upper body dressing, FIM cooperation, FIM eating, and FIM walking/wheelchair. The relationship between caregivers’ hours of sleep and each FIM item is shown in Table 3.

Multiple regression analysis with caregivers’ hours of sleep as the dependent variable

The results of multiple regression analysis with caregiver’s hours of sleep as the dependent variable are shown in Table 4. Using items with correlation coefficients over 0.2 as the independent variable showed FIM memory to be significant ($\beta=0.618$, $P=0.000$; adjusted $R^2=0.361$, $P=0.000$).

Using only FIM motor items with correlation coefficients over 0.200 as the independent variable showed FIM bowel management to be significant ($\beta=0.590$, $P=0.000$; adjusted $R^2=0.326$, $P=0.000$).

Relationship between the difference between the expected and actual amount of care provided and care receiver and caregiver characteristics

The relationship between the difference between the expected and actual amount of care provided by family caregivers and each FIM item is shown in Table 5. The items with correlation

Table 3. Relationship between caregivers' hours of sleep and care receiver and caregiver characteristics

Variable	Correlation coefficient	P value
Care receiver factors		
Age	-0.075	0.690
Gender	—	0.460
Nursing care level	-0.165	0.374
FIM	0.423	0.018
FIM-Motor	0.420	0.019
FIM-Cognitive	0.444	0.012
Eating	0.227	0.220
Grooming	0.184	0.321
Bathing	0.254	0.167
Dressing, upper body	0.106	0.569
Dressing, lower body	0.148	0.428
Perineal care	0.341	0.060
Bladder management	0.531	0.002
Bowel management	0.667	0.000
Transfer, bed, wheelchair	0.118	0.526
Transfer, toilet	0.177	0.342
Transfer, tub or shower	0.259	0.159
Walking/Wheelchair	0.204	0.271
Stairs	0.288	0.117
Comprehension	0.013	0.944
Expression	-0.098	0.601
Cooperation	0.240	0.193
Problem solving	0.379	0.035
Memory	0.648	0.000
Caregiver factors		
Age	0.101	0.590
Gender	—	0.335
Relationship	—	0.667
J-ZBI_8	-0.641	0.000
Frequency of visit	0.058	0.757

Spearman's rank correlation coefficient and Chi-squared test was used. FIM: functional independence measure; J-ZBI_8: The short version of the Japanese version of the Zarit Caregiver Burden Interview.

coefficients over 0.200 were FIM memory, FIM bowel management, FIM cooperation, FIM problem solving, FIM bladder management, FIM expression, FIM eating, FIM comprehension, and the frequency of hospital visits.

Multiple regression analysis with the difference between the expected and actual amount of care provided by family caregivers as the dependent variable

The results of multiple regression analysis with caregivers' hours of sleep as the dependent

variable are shown in Table 6. Using items with correlation coefficients over 0.200 as the independent variable showed FIM memory ($\beta=0.373$, $P=0.021$), FIM comprehension ($\beta=0.501$, $P=0.003$), FIM cooperation ($\beta=0.472$, $P=0.010$), and frequency of hospital visits ($\beta=0.301$, $P=0.040$) (adjusted $R^2=0.460$, $P=0.040$) to be significant.

Using only FIM motor items with correlation coefficients over 0.200 as the independent variable showed FIM bowel management to be significant ($\beta=0.402$, $P=0.025$).

Table 4. Results of multiple regression analysis with caregivers' hours of sleep as the dependent variable

1. Using all items with a correlation coefficient over 0.2 as the independent variable

	β	<i>P</i> value
Independent variable	0.618	0.000
Memory		
	R^2 0.361	0.000

2. Using FIM motor items with a correlation coefficient over 0.2 as the independent variable

	β	<i>P</i> value
Independent variable	0.590	0.000
Bowel management		
	R^2 0.326	0.000

Table 5. Relationship between the difference between the expected and actual amount of care provided and care receiver and caregiver characteristics

Variable	Correlation coefficient	<i>P</i> value
Care receiver factors		
Age	0.055	0.769
Gender	—	0.932
Nursing care level	-0.197	0.289
FIM	0.213	0.249
FIM-Motor	0.200	0.280
FIM-Cognitive	0.309	0.090
Eating	0.301	0.100
Grooming	0.169	0.362
Bathing	0.086	0.644
Dressing, upper body	0.068	0.717
Dressing, lower body	0.053	0.779
Perineal care	-0.024	0.898
Bladder management	0.331	0.069
Bowel management	0.434	0.015
Transfer, bed, wheelchair	0.120	0.521
Transfer, toilet	0.113	0.546
Transfer, tub or shower	0.158	0.396
Walking/Wheelchair	0.034	0.857
Stairs	0.155	0.404
Comprehension	0.268	0.149
Expression	0.327	0.072
Cooperation	0.403	0.025
Problem solving	0.351	0.053
Memory	0.461	0.009
Caregiver factors		
Age	0.164	0.378
Gender	—	0.688
Relationship	—	0.972
J-ZBI_8	-0.623	0.000
Frequency of visit	0.256	0.165

Spearman's rank correlation coefficient and Chi-squared test was used. FIM: functional independence measure; J-ZBI_8: The short version of the Japanese version of the Zarit Caregiver Burden Interview.

Table 6. Results of multiple regression analysis with the difference between the expected and actual amount of care provided as the dependent variable

1. Using all items with a correlation coefficient over 0.2 as the independent variable		
	β	<i>P</i> value
Independent variable		
Memory	0.373	0.021
Comprehension	0.501	0.003
Cooperation	0.472	0.010
Frequency of visit	0.301	0.040
	R^2	0.460
		0.040
2. Using FIM motor items with a correlation coefficient over 0.2 as the independent variable		
	β	<i>P</i> value
Independent variable		
Bowel management	0.402	0.025
	R^2	0.326
		0.000

Discussion

We investigated the factors influencing caregiver burden first based on the difference between the expected and actual amount of care provided by family caregivers, and the care environment, then based on the characteristics of care receivers and caregivers, and the relationship between care receivers and caregivers. As a new finding in this research, it suggested that the prediction accuracy of nursing care after discharging might influence the care burden.

Factors influencing caregivers' hours of sleep

Our findings were supported by previous studies, Hotta⁵⁾ and Suzuki et al.⁶⁾, who also reported that the sleeping hours per day is related to caregiver burden.

FIM memory was a factor significantly influencing caregivers' hours of sleep when no limits were placed on the dependent variable, and FIM bowel management was significant when only FIM motor was used as the dependent variable. FIM memory includes skills related to recognizing and remembering verbal and visual information while performing daily activities in

an institutional or social setting and is related to both cognition and memory. A deficit in memory affects not only the performance of tasks, but also learning. As evaluation factors, these abilities include remembering ADL, recognizing familiar people, and following instructions⁷⁾. When these elements are obstructed, a decrease in cognitive function occurs and behavioral and psychological symptoms of dementia (BPSD) can result. There are many reports about the relationship between BPSD and caregiver burden^{8,9)} and it is known that wandering and nocturnal awakening might decrease caregivers' hours of sleep.

Bowel management was found to have a significant suggest on caregivers' hours of sleep. Bowel management is judged by whether the patient can relax their sphincter in time, and how often the patient stains their underwear and whether they can dispose properly. Bladder management is similar to bowel management. In fact, the correlation coefficient for bladder management and caregivers' hours of sleep was the second highest in the FIM motor subscale. The reason why bowel management was significant is that while urination can be controlled with diapers and pads, and wiping can be completed

in a short time, but depending on the amount and shape of defecation, it is difficult to control with a diaper or pad, and it may take time to clean up. There is a high correlation between urinary and fecal incontinence, caregivers' hours of sleep might be decreased by both types of incontinence.

Factors influencing the difference between the expected and actual amount of care provided by family caregivers

Using all dependent variables, FIM comprehension, FIM cooperation, FIM memory, and frequency of hospital visits were found to be factors that significantly suggest the difference between the expected and actual amount of care provided by family caregivers. In addition, using only the FIM motor subscale as the dependent variable, bowel management was found to be significant. In addition to FIM memory, both FIM comprehension and FIM cooperation are categorized into the FIM cognition subscale. FIM evaluates whether a patient can listen to what others say; therefore, patients with mind-wandering, aphasia and hearing loss easily obtain lower scores.

One of the evaluation criteria for FIM cooperation is whether a patient can communicate with others without any trouble. The reason for this is because when care receivers' cognitive function declines due to cerebrovascular disease and rest after surgery, patients were often discharged without the family fully understanding their condition and recovery needs.

Particularly, when patients without any physical problems experience a decline in cognitive function, it is more difficult for their family to notice changes in them because their physical function is the same. This may cause a big difference between the expected and actual amount of care provided by family caregivers, which in turn affects caregiver burden. In addition, patients tend to try hard to maintain ADL but after

hospitalization, some patients have to rely on their family. The reason why the frequency of hospital visits was significant is that many visits make it possible to for the caregiver to more understand the patient's condition thus decrease the difference between the expected and actual amount of care.

Bowel management was found to have a significant suggest on the difference between the expected and actual amount of care provided by family caregivers. The greater the frequency of diaper changes, the greater the difference in the expected and actual amount of care. During hospitalization, hospital staff such as nurses usually change patients' diapers. Therefore, the family's lack of experience with this aspect of caregiving can affect the difference between the expected and actual amount of care provided by family caregivers. Furthermore, because hospital staff are professionals, the family can underestimate the difficulty of this task and think that they can easily take care of the patient.

Based on the above, when the cognitive function and excretory management ability of the care receiver were low or when the visiting frequency is low, the difference between the expectation and the sleeping time of the caregiver is shortened after discharge, therefore, the feeling of burden of long-term care burden is tend to increase.

Limitations and outlook for the future of study

In this study, we investigated the factors influencing caregiver burden after hospitalization in the convalescent ward. The results showed that a lack of excretion control at night and cognitive function are factors. Regarding cognitive function, this study was considered only the cognitive of FIM, it did not clarify the problem behavior of the care receiver affecting the difference in feeling of burden of nursing care than expectation, or the sleeping time of caregiver.

In the future it is likely to research on the care recipient's BPSD.

In addition, in this study, we only identified the case where the risk of care burden feeling was high. In the future, we would like to research how to establish a family support system in the convalescent ward.

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