Original Article

Characteristics of family caregivers with sleep dissatisfaction in Japan: Identification using CHAID dendrograms

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Summary   The rapid increase in the population of the elderly has raised several social issues. The current study focused on sleep dissatisfaction in family caregivers to identify family caregivers with a heavy care burden. This study aimed to detect the characteristics of caregivers who are most likely to have sleep dissatisfaction. A chi-squared automatic interaction detection technique was used to analyze data collected from 92 research care managers who collected demographic and sleep dissatisfaction information from 280 caregivers and their care recipients. Caregivers whose care recipients were unstable and bedridden were most likely to have sleep dissatisfaction. When care recipients were not stable or non-bedridden, had severe dementia symptoms, and were physically independent, their caregivers were the second most likely to have sleep dissatisfaction. When care recipients were not stable or non-bedridden, had moderate dementia symptoms, and did not need help in transferring, their caregivers had the lowest risk of sleep dissatisfaction. Although many recent studies have found a high prevalence of insomnia among the elderly, describing the characteristics of caregivers who are most likely to have sleep dissatisfaction is a significant challenge. When care recipients are physically independent, the severity of the recipient's dementia symptoms relates to the caregiver's dissatisfaction with his/her sleep. In physically dependent care recipients, the severity of the recipient's dementia did not contribute to the caregiver's dissatisfaction with his/her sleep.

Keywords: Sleep dissatisfaction, long-term care, caregiver burden, community nursing

1. Introduction

Increasing health care costs for the disabled elderly have become an important issue in developed countries. Prolonging home care has been effective at reducing health care costs (*1*), but the disabled elderly must then remain independent and stay at home. In Asian countries, family members are often expected to play a caregiving role at home. Family members often experience a conflict between the caregiving role and their other roles (*2*) or are subjected to a heavy burden of providing care. When looking at prolonged home care, family caregivers with a heavy care burden must be identified and their load must be reduced.

Some studies have reported that sleep problems, which include insomnia, are an important component of the caregiving load that causes mental disorders among caregivers (*3-5*). In a recent review, McCurry, Logsdon, Teri, and Vitiello (*6*) noted that changes in caregiver sleep patterns are caused by multiple factors, including factors on the part of both the caregiver and care recipient. The most common factors in caregivers' sleep disorders are gender and age. Older females have a higher risk of increased sleep latency, decreased sleep maintenance, decreased slow-wave and rapid eye movement (REM) sleep, nocturnal temperature dysregulation, more frequent shifts between sleep stages, and circadian rhythm disturbances, particularly in the advanced sleep phase (*7*). These age-related changes contribute to increased nighttime wakefulness and fragmentation of sleep.

That said, factors related to care recipients also

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cause changes in caregivers' sleep patterns. When care recipients need frequent assistance during the night, caregivers experience events that precipitate nighttime wakefulness. In particular, nighttime behavior by care recipients affects sleep patterns of their caregivers. Research shows that nighttime activity, as well as waking at night to urinate or taking a walk around the house, is one of the most common reasons cited for moving a family member with dementia into an institutional setting (*8*).

With society aging, more care recipients will need personal and medical care during the night, resulting in more caregivers suffering from sleep disorders. However, no studies have described caregivers who are at-risk for a sleep disorder. Data on the characteristics of caregivers who are the most likely to have a sleep disorder may help health care professionals to assess nocturnal care needs in various clinical settings and develop strategies to decrease a family caregiver's burden.

Data mining has been found to help understand how subjects' patterns relate to their own special situations. One commonly used data mining technique includes the chi-squared automatic interaction detector (CHAID), which has been used to segment the population into homogeneous subgroups. Forthofer and Bryant (*9*) used CHAID to compare various approaches to developing strategies to change health behaviors. Their results not only provide insight into the determinants of breast cancer screening among women but also enable researchers to identify unique characteristics of population segments with greater needs and to focus intervention resources in a manner that is likely to maximize intervention impact. Naruse *et al.* used CHAID to develop a service need pattern model for the elderly. They identified service needs among the elderly based on patterns (*10*).

Sleep dissatisfaction is one of the main factors that cause insomnia (*11*). Insomnia, which is characterized by inadequate or poor quality of sleep (*12*), may be a primary sleep disorder or might manifest itself as a co-occurring condition with a psychiatric, medical, or other sleep disorder. Although sleep dissatisfaction is not the same as sleep disturbance, it may be a reasonable index of insomnia. Therefore, the purpose of the current study is to use data mining – CHAID – in order to segment caregivers into homogeneous subgroups on the basis of their sleep dissatisfaction rates. This approach aims to develop a strategy that detects and helps caregivers who are at-risk for sleep dissatisfaction.

2. Materials and Methods

2.1. *Individuals cared for under the long-term care insurance system in Japan*

Long-term care insurance (LTCI) was established in April 2000 (*13*). The Japanese government has recommended that the elderly continue to live in their own homes and use home-based services provided by this insurance system for support. Under the system, two groups of people can use the LTCI services: people aged 65 years or older who are in need of daily care, including those who are bedridden, suffering from dementia, or housebound, and people aged 40 to 64 years who need daily care because of illnesses such as dementia and cerebrovascular disease. Levels of care range from support and care level 1 (requires help with activities of daily living (ADL)) to level 5 (requires maximum care). To ensure their independence, users of LTCI can tailor their services to conform to their own care plan. Usually, such plans are developed by care managers who are professionals in managing the care of the elderly.

2.2. *Study design and participants*

This study analyzed data that were obtained from individuals who participated in an earlier study investigating the characteristics of the elderly; these elderly individuals were most likely to need home help and home nursing (*10*). Ninety-two care managers, who are professional care planners in the LTCI system (*13*), from 32 care management offices in the southern district of Shiga Prefecture participated in this study as research care managers (RCMs). The RCMs chose primary caregivers for care recipients (from care levels 2, 3, 4, and 5) as study participants. A primary caregiver was defined as the person who took the most care of the care recipient among his/her family members. To avoid selection bias, caregivers whose care recipient's date of birth was closest to August 1 were selected at each level of care. A total of 320 elderly individuals were selected.

Between July and September 2008, the researchers visited the primary caregivers of those individuals and explained the purpose of the survey. If they agreed to participate, the RCMs gathered data, including demographic information and assessments of the status of the elderly individual. Participants were then interviewed by the RCMs using a structured questionnaire. This study was approved by the Ethics Committee of the Graduate School of Medicine at the University of Tokyo.

2.3. *Conceptual guide*

Independent variables that explain sleep dissatisfaction were selected by referring to a disease model that explained the causes of insomnia. Insomnia, which is characterized by inadequate or poor quality of sleep, may be a primary sleep disorder or manifest itself as a co-occurring condition with a psychiatric, medical, or different sleep disorder. Spielman's 3P model shows that three types of factors are involved at different

points during the course of insomnia: predisposing, precipitating, and perpetuating factors (*14*). Predisposing factors are not a direct cause of insomnia, but they increase an individual's risk of developing sleep difficulties. Precipitating factors are the life events and the medical, environmental, or psychological factors that trigger insomnia, and perpetuating factors maintain or exacerbate sleep difficulties. Caregivers' demographic variables were selected as predisposing factors, and care recipients' demographic variables were selected as precipitating and perpetuating factors.

2.4. *Variables*

To formulate a questionnaire for the RCMs and family caregivers, five care managers were recruited for a pilot test. All variables were selected and modified in order to create a clear and feasible instrument for RCMs. According to the care managers, lifestyles of care recipients and caregivers were so irregular that they could not answer questions about them over the long-term. Taking these constantly changing conditions into consideration, all questions concerned the lives of family caregivers over the past week.

Caregivers' sleep dissatisfaction was examined as a dependent variable. Here, the sleep dissatisfaction index from the life habit inventory developed by the Tokyo Metropolitan Institute for Neuroscience (*15*) was adopted. As in Hayashi and Hori (*16*), participants were divided into 2 categories: those who were satisfied with their sleep and those who were dissatisfied with their sleep. On this scale, sleep dissatisfaction was measured using three items: mood (good, bad), amount of sleep (sufficient, insufficient), and quality of sleep (good, bad). If a person answered "good" or "sufficient" to all of the items, he/she was considered to be satisfied with his/her sleep. If a person answered otherwise, he/she was considered to be dissatisfied with his/her sleep.

Demographic variables for caregivers included age, gender, family relationship, living situation, duration of caregiving, and frequency of care by a second caregiver. Demographic variables for care recipients included age, gender, daily functioning, severity of dementia symptoms, severity of illness and presence of conditions or impairments, level of care, and living arrangements.

Using the Katz index of independence, the difficulties experienced by care recipients' in ADL (bathing, dressing, toileting, transferring, incontinence, and feeding) (*17*) were measured. In addition, the degree of independent living for the elderly was used (*18*). This scale was established by the Japanese Ministry of Health and Welfare and is commonly used among Japanese community health agencies to assess daily conditions among the elderly. Using this index, RCMs judged whether the elderly person was independent (did not need help to perform daily activities at home)

or dependent (needed help to perform daily activities at home). The severity of dementia symptoms was assessed using the Japanese index of independence/ dementia symptoms (*19*). This index was established by the Japanese Ministry of Health and Welfare. Using this index, care managers judged whether the elderly had moderate dementia symptoms (did not need help in daily life because of dementia symptoms) or severe dementia symptoms (needed help in daily life because of dementia symptoms). The presence of conditions or impairments in each care recipient was also measured using the two most important medical diagnoses considered by RCMs in devising a care plan. Further, the RCMs indicated whether or not the care recipients were terminal.

To compare the care needs of the elderly, which were categorized based on dendrograms, the RCMs asked caregivers about the time spent caregiving and considered care during the night before the interview. In all, four care items were examined: suction, postural change, toileting support, and diaper change. Toileting support included transferring the elderly person to the toilet, helping them remove clothing, and wiping the diaper area clean. These factors were selected as they were considered necessary throughout the day.

2.5. *Statistical analysis*

Before data mining for the research question, the relationships between the demographic variables and participants' sleep dissatisfaction were examined by using an unpaired *t* test, chi-squared test, and Fisher's exact test.

Next, the research question was addressed using CHAID analysis, a nonparametric analysis based on statistically recursive partitioning algorithms. The CHAID technique determines the relative importance of each of the independent (predictor) variables in explaining group membership in a categorical dependent (outcome) variable. The technique involves two steps. In the first, the independent variables are stratified into alternative ordinal groupings to ensure similar percentage distributions of the dependent variable among these categories. Groups may be formed by any possible combination of the levels of an independent variable or by placing cut points at any value of a continuous predictor. In the second step, the technique uses χ^2 significance levels to determine which independent variable explains the most variance in the dependent variable. The process is repeated for all significant predictor variables until no further significant χ^2 values are obtained.

Dendrograms are used to display the relative importance of significant independent variables for the dependent variable. The hierarchical nature of the CHAID dendrograms provides a visual depiction of criterion and predictor variable interactions that might

not be detected in traditional analytical procedures. The variable at the highest level of the tree is considered to have the closest statistical association with the dependent variable. The CHAID technique has traditionally been used in business and marketing research (*20*), and its use is increasing in rehabilitation and mental health studies (*21,22*).

In the current analysis, groups were split until the following criteria were reached. The tree depth was limited to three levels – no group smaller than 40 was split, and no group smaller than 20 was formed. The alpha level for all statistical tests was 0.05, corrected for the number of statistical tests within each predictor using a correction factor analogous to the Bonferroni technique. SPSS ver.17 and Decision tree ver.17 were used for the CHAID analysis.

3. Results

3.1. *Response rates and demographic characteristics*

Of the 320 caregivers selected for this study, 300 (93.8%) agreed to participate. Two hundred and eighty (87.5%) participants were included in the analysis, and 20 were excluded because of incomplete data. Table 1 shows the demographic characteristics of caregivers. Their average age was 64 years. Of the caregivers,

50% were under 64 years, 80% were female, 40% were daughters (including in-laws), and 30% were wives. Almost all the caregivers lived with the elderly individual, and half of them spent more than half a day providing care. Seventy percent were supported by second caregivers.

One hundred eighty-nine participants (67.5%) were dissatisfied with their sleep. Time spent caregiving (χ^2 = 7.85, p = 0.049) and the frequency of care by a second caregiver (χ^2 = 12.5, p = 0.014) were significantly related to participants' sleep dissatisfaction.

3.2. *Demographic characteristics of care recipients*

Table 2 shows the demographic characteristics of care recipients. Their average age was 80 years. Of the care recipients, 50% were female. There were 81 (28.9%) care recipients at care level 2, 76 (27.1%) at level 3, 68 (24.3%) at level 4, and 55 (19.6%) at level 5. Over 60% had ADL difficulties in bathing (84.3%), dressing (81.8%), toileting (80.7%), and transferring (62.9%), as well as incontinence (78.6%). Almost 30% had difficulty eating. Around half the recipients needed help in daily activities as they were physically dependent (59.6%) and had severe dementia (47.5%).

A significant number of participants caring for care recipients who had difficulty with incontinence and

Table 1. Characteristics of participants (*n* = 280)

Variables	Total		Sleep satisfaction				*p*
			Satisfied (*n* = 91)		Dissatisfied (*n* = 189)		
	n	(%)	*n*	(%)	*n*	(%)	
Age (years)							
< 65	137	(48.9)	42	(46.2)	95	(50.3)	0.527[a]
≥ 65	143	(51.1)	49	(53.8)	94	(49.7)	
Gender							
Female	216	(77.1)	65	(71.4)	151	(79.9)	0.129[a]
Family relationship							
Wife	92	(32.9)	26	(28.6)	66	(34.9)	0.512[a]
Husband	37	(13.2)	16	(17.6)	21	(11.1)	
Daughter	116	(41.4)	36	(39.6)	80	(42.3)	
Son	23	(8.2)	9	(9.9)	14	(7.4)	
Other	12	(4.3)	4	(4.4)	8	(4.2)	
Duration of caregiving (years)							
< 1	39	(13.9)	9	(10.0)	30	(16.2)	0.180[a]
1-5	109	(38.9)	33	(36.7)	76	(41.1)	
> 5	127	(45.4)	48	(53.3)	79	(42.7)	
Living situation							
Living with the elderly person	266	(95.0)	87	(95.6)	179	(94.7)	1.000[a]
Living apart	14	(5.0)	4	(4.4)	10	(5.3)	
Time spent caregiving per day							
All day	71	(25.4)	15	(17.0)	56	(30.3)	0.049[a]
Half a day	72	(25.7)	24	(27.3)	48	(25.9)	
Two or three hours	65	(23.2)	22	(25.0)	43	(23.2)	
Often	59	(21.1)	26	(29.5)	33	(17.8)	
Frequency of care by a second caregiver							
No second caregiver	63	(22.5)	15	(16.9)	48	(25.4)	0.014[a]
One-two days/week or less	109	(37.9)	47	(52.8)	62	(32.8)	
Three-four days/week	40	(14.3)	13	(14.6)	27	(14.3)	
More than five days/week	66	(23.6)	14	(15.7)	52	(27.5)	

Numbers are *n* (%), [a] Chi-squared test.

Table 2. Characteristics of care recipients (*n* = 280)

Variables	Total		Sleep satisfaction				*p*
			Satisfied (*n* = 91)		Dissatisfied (*n* = 189)		
	n	(%)	*n*	(%)	*n*	(%)	
Age (years)							
< 65	18	(6.4)	7	(7.7)	11	(5.8)	0.605[e]
≥ 65	262	(93.6)	84	(92.3)	178	(94.2)	
Gender							
Female	153	(54.6)	52	(57.1)	101	(53.4)	0.560[e]
Care level[a]							
Level 2	81	(28.9)	29	(31.9)	52	(27.5)	0.271[e]
Level 3	76	(27.1)	28	(30.8)	48	(25.4)	
Level 4	68	(24.3)	22	(24.2)	46	(24.3)	
Level 5	55	(19.6)	12	(13.2)	43	(22.8)	
Functional status (ADL[b] difficulties)							
Bathing	236	(84.3)	72	(79.1)	164	(86.8)	0.099[e]
Dressing	229	(81.8)	71	(78.0)	158	(83.6)	0.258[e]
Toileting	226	(80.7)	68	(74.7)	158	(83.6)	0.078[e]
Transferring	176	(62.9)	51	(56.0)	125	(66.5)	0.090[e]
Incontinence	220	(78.6)	63	(69.2)	157	(83.1)	0.008[e]
Eating	80	(28.6)	19	(20.9)	61	(32.3)	0.048[e]
Degree of independent living[c]							
Independent	113	(40.4)	35	(38.5)	78	(41.3)	0.654[e]
Dependent	167	(59.6)	56	(61.5)	111	(58.7)	
Severity of dementia[d]							
Moderate	147	(52.5)	58	(63.7)	89	(47.1)	0.009[e]
Severe	133	(47.5)	33	(36.3)	100	(52.9)	
Presence of conditions or impairments							
Dementia	117	(41.8)	35	(38.5)	82	(43.4)	0.434[e]
Cerebrovascular disorder	99	(35.4)	39	(42.9)	60	(31.7)	0.069[e]
Heart disease	32	(11.4)	7	(7.7)	25	(13.2)	0.173[e]
Neurological disorder	28	(10.0)	10	(11.0)	18	(9.5)	0.702[e]
After fracture	27	(9.6)	7	(7.7)	20	(10.6)	0.443[e]
Severity of illness index							
Stable	226	(80.7)	78	(85.7)	148	(79.1)	0.016[e]
Unstable and not bedridden	31	(11.1)	12	(13.2)	19	(10.2)	
Unstable and bedridden	21	(7.5)	1	(1.1)	20	(10.7)	
Terminal status	4	(1.4)	2	(2.2)	2	(1.1)	0.597[f]
Living arrangements							
Alone	8	(2.9)	2	(2.2)	6	(3.2)	0.682[e]
With one person	69	(24.6)	25	(27.8)	44	(23.4)	
With two or more persons	201	(71.8)	63	(70.0)	138	(73.4)	

Numbers are *n* (%). [a] Care level = individual's level of care needed: "Level 2" = moderate care needed, "Level 3" = considerable care needed, "Level 4" = critical care needed, "Level 5" = maximum care needed. [b] ADL = activity of daily living. [c] Degree of independent living: "Independent" = did not need help to perform daily activities at home, "Dependent" = needed help to perform daily activities at home. [d] Severity of dementia: "Moderate" = did not need help in daily life because of dementia symptoms, "Severe" = needed help in daily life because of dementia symptoms. [e] Chi-squared test. [f] Fisher's exact test.

eating ($\chi^2 = 7.0$, $p = 0.008$; $\chi^2 = 3.9$, $p = 0.048$) and who had severe dementia ($\chi^2 = 6.83$, $p = 0.009$) tended to be dissatisfied with their sleep. In addition, the care recipients' severity of illness index was significantly associated with participants' sleep dissatisfaction ($\chi^2 = 8.3$, $p = 0.016$).

3.3. *CHAID dendrograms describing the characteristics of those who are most likely to be dissatisfied with their sleep*

CHAID dendrograms were used to explore the demographics of the participants who were dissatisfied with their sleep. Figure 1 illustrates the relative importance of the significant independent variables in determining sleep dissatisfaction. The independent variables used in the model were the demographic characteristics of the participants and care recipients. Among the factors most closely associated with a participant's sleep dissatisfaction, the care recipient's severity of illness index was the most significant ($\chi^2 = 12.1$, df = 1, $p = 0.008$) in two categories: (a) unstable and bedridden and (b) stable or non-bedridden. Participants caring for care recipients who were unstable and bedridden tended to be dissatisfied with their sleep (95.7%) (Group A, Node 2) more than those caring for other groups of care recipients.

Participants caring for care recipients who were stable or non-bedridden tended not to be dissatisfied with their sleep (65.0%) (Node 1) compared to those caring for care recipients in Group A. For this group, care recipients' severity of dementia was the next most
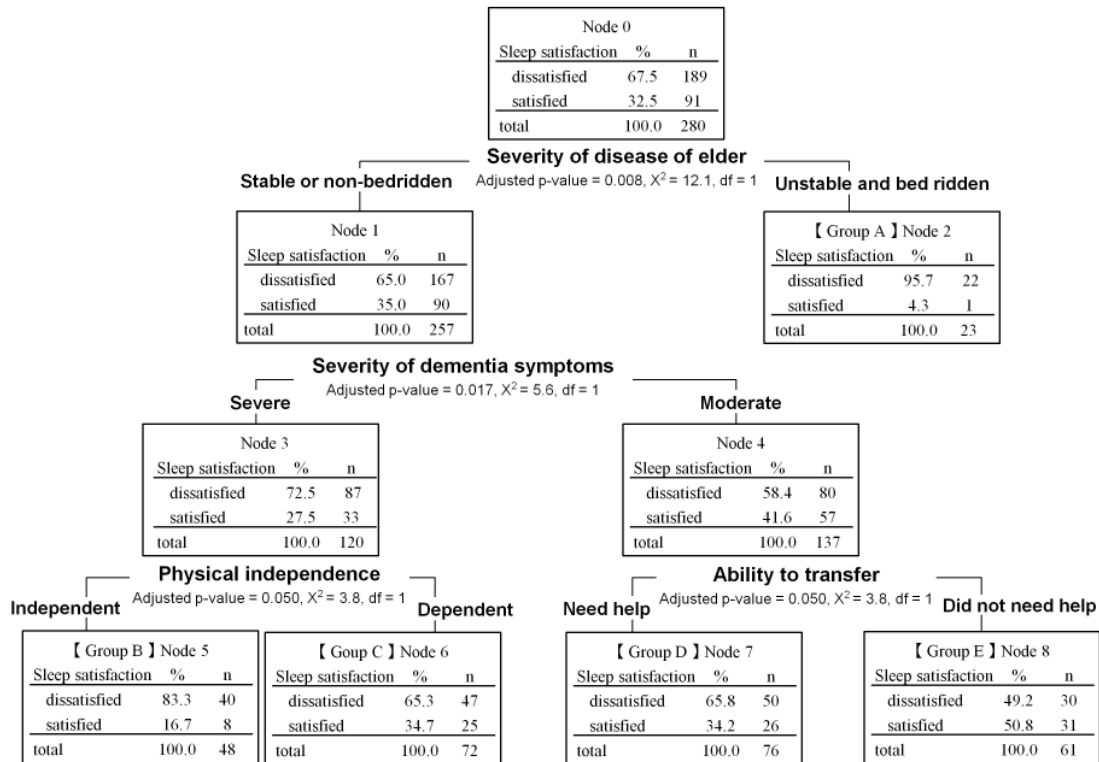
Figure 1. Dendrogram of Chi-squared Automatic Interaction Detection for sleep dissatisfaction. Care recipients cared for by a total of 280 participants were divided into 5 groups: Groups A, B, C, D, and E. The prevalence of participants who were dissatisfied with their sleep was highest among those caring for care recipients in Group A (95.7%) and lowest among those caring for care recipients in Group E (49.2%).

significant variable in determining participants' sleep dissatisfaction ($\chi^2 = 5.6$, df = 1, $p = 0.017$). Participants caring for care recipients who were stable or non-bedridden and had severe dementia symptoms tended to be dissatisfied with their sleep more (72.5%) (Node 3). In this group, participants caring for care recipients who were physically independent tended to be more dissatisfied (83.3%) (Group B, Node 5) than those caring for the other group of care recipients (65.3%) (Group C, Node 6).

Participants caring for care recipients who were stable or non-bedridden and had moderate dementia symptoms tended to be not dissatisfied with their sleep (58.4%) (Node 4). Unlike the previous group, transferring was the next most significant predictor of participants' sleep dissatisfaction ($\chi^2 = 3.8$, df = 1, $p = 0.050$); participants whose care recipients did not need help with transferring (49.2%) (Group E, Node 8) tended to be dissatisfied with their sleep significantly less than those caring for care recipients who needed help (65.8%) (Group D, Node 7). Caregivers who were dissatisfied with their sleep were least prevalent among participants caring for care recipients in Group E.

3.4. *Care needs of groups of care recipients in CHAID dendrograms*

Table 3 shows the care recipients' care needs at night.

In Group A, more recipients had suction treatment needs (26.1%) and postural change needs (47.8%) than the other groups of care recipients. Care recipients in Groups A and C received care for more than two hours at night and needed more diaper changes (56.5%, 59.7%) than the other groups. Elderly individuals in Group E received care for a shorter duration than the other groups and had fewer care needs.

4. Discussion

Most developed nations emphasize preventing the deterioration associated with chronic conditions because of the increasing burden on caregivers for the elderly. To this end, clinical investigators and health care organizations have been using care services to address caregivers' sleep disturbances. Moreover, health care professionals need to develop strategies for efficient and effective care delivery.

The current study examined the characteristics of caregivers who are dissatisfied with their sleep. The independent variables used in the CHAID models are well-known risk factors associated with a sleep disturbance (*23,24*). Therefore, the primary contribution of this study is to identify caregivers who are most likely to have sleep dissatisfaction. An elderly person who needs more or greater care has a greater impact on the caregiver's sleep dissatisfaction than dose the status

Table 3. The care needs of elderly during the night

Variables	Group A[a] (*n* = 23) M (S.D.)	Group B[b] (*n* = 48) M (S.D.)	Group C[c] (*n* = 72) M (S.D.)	Group D[d] (*n* = 76) M (S.D.)	Group E[e] (*n* = 61) M (S.D.)
Length of care (min/day)	130.4 (72.8)	97.5 (87.7)	145.0 (120.3)	100.6 (71.9)	59.2 (70.8)
Care provided (*n* (%))					
Suction	6 (26.1)	0 (0.0)	1 (1.4)	3 (3.9)	0 (0.0)
Postural change	11 (47.8)	0 (0.0)	19 (26.4)	10 (13.2)	0 (0.0)
Toileting support[f]	0 (0.0)	11 (22.9)	16 (22.2)	27 (35.5)	11 (18.0)
Diaper change	13 (56.5)	18 (37.5)	43 (59.7)	25 (32.9)	4 (6.6)

Numbers are *n* (%). [a] Group A: Care recipients were unstable and bedridden. [b] Group B: Care recipients were stable or non-bedridden, had severe dementia, and could perform daily activities independently. [c] Group C: Care recipients were stable or non-bedridden, had severe dementia, and were physically dependent on caregivers to perform daily activities. [d] Group D: Care recipients were stable or non-bedridden, had moderate/no dementia, and needed help transferring. [e] Group E: Care recipients were stable or non-bedridden, had moderate/no dementia, and did not need help with transferring. [f] Toileting support includes transferring to the toilet, helping the elderly person to remove clothing, and wiping the diaper area clean.

or condition of the caregiver.

In accordance with Spielman's 3P model, sleep disturbances will occur when a person who is predisposed to poor sleep experiences an event that precipitates nighttime wakefulness. For caregivers, the precipitating event may often be providing care at night.

Care recipients in Group A were unstable and bedridden, so their caregivers had the highest risk of sleep dissatisfaction. The care recipients in this group needed more medical treatment and personal care than those in the other groups. Conversely, care recipients in Group E were stable or non-bedridden and were capable of performing ADL independently, so their caregivers had the lowest risk of sleep dissatisfaction; the prevalence of sleep dissatisfaction among these caregivers was as low as that among the general Japanese population (*25*). These results indicate that caring for an elderly individual who needs more care at night will impact the sleep of the person caring for that individual.

Care recipients in Group B needed daily help because of severe dementia but their physical abilities were unaffected, and caregivers caring for this group had the second highest risk of sleep disorders. Over 80% of caregivers caring for care recipients in Group B were dissatisfied with their sleep, which is about 20% higher than those caring for care recipients in Groups C and D. The severity of dementia among the care recipients in Group C was similar to that among care recipients in Group B, and care recipients in Group C also needed physical support. Indeed, more care recipients in Group C needed a postural change and elimination assistance than did those in Group B. Furthermore, dissatisfaction among caregivers caring for care recipients in Group C was on par with that among caregivers caring for care recipients in Group D, who did not have severe dementia but needed physical support. Clearly, if a person with dementia is awake and moving around the house at night, this behavior impacts the sleep of his/her caregiver. In other words, a caregiver's dissatisfaction with his/her sleep was not explained only by caring for an individual who had

severe dementia and was physically dependent. This result shows that when care recipients were physically independent, the severity of the recipient's dementia was associated with the caregiver's dissatisfaction with his/her sleep. When care recipients were physically dependent, however, the severity of the recipient's dementia did not contribute to the caregiver's dissatisfaction with his/her sleep.

Over 80% of caregivers caring for care recipients in Groups A and B were dissatisfied with their sleep, so these caregivers are considered to have a higher risk of sleep dissatisfaction. For Group A, formal visiting nurses, rather than informal caregivers, are needed to provide medical or personal care in order to resolve the caregiver's dissatisfaction with his/her sleep. However, in Japan there is a particularly notable discrepancy between need for home-visiting nursing services at night and their actual use (*10*). More home-visiting nurses should provide care at night so that individuals caring for care recipients in Group A will be more satisfied with their sleep.

Care recipients in group B have dementia and are thus awake and moving about at night, so time-specific home care services would have difficulty resolving the dissatisfaction of persons caring for such individuals. Because a home care service provider can stay by the individual's side for only a short time of about 30 to 60 min, these services do not allow caregivers respite when the individuals they care for stay awake throughout the night.

Lessen the caregiving load of elimination assistance is crucial to resolving sleep dissatisfaction among caregivers. About 35% or more of the care recipients in all groups other than Group E needed elimination assistance, including toileting support and diaper change at night. A previous study reported that elimination assistance for community-dwelling elderly at night was usually provided by family caregivers rather than formal services (*26*).

This study had several limitations. Examining sleep dissatisfaction cannot be equated with the study of sleep disturbance. More objective examination is needed to understand sleep disturbance among high-

risk groups. Since this study was conducted in only one prefecture, it does not allow generalizations. Furthermore, the sleep hygiene and use of psychological sleep therapy, employment status, and other daily activities of caregivers were not considered. Moreover, psychological factors such as caregivers' anxiety and distress, which are considered to be related to sleep disturbance (27), were not included as predisposing factors. This was because this study's aim was to include only objective factors in dendrograms to facilitate use in clinical settings. However, a more multidimensional examination may better explain the sleep problems of caregivers.

Despite its limitations, this study has clarified the characteristics of caregivers who are dissatisfied with their sleep and the prevalence of sleep dissatisfaction among those individuals. In order to plan appropriate care, health care professionals need to understand the care recipient's needs and address the gap between the care provided and care recipient's needs. Caregivers providing care to care recipients in Group A were the most dissatisfied with their sleep, so more home-visiting nurse services should provide care at night. Caregivers providing care to care recipients in Group B were also dissatisfied with their sleep, but time-specific home care services would have difficulty resolving their sleep dissatisfaction. However, long-term-stay health care professionals or respite services in the community could help those caregivers.

Many studies have found a greater prevalence of insomnia among older people (28,29). In the near future, caregivers will also grow older. An effective and efficient health care system that addresses caregivers' sleep problems will thus be increasingly important. The current results can help health care professionals assess community needs and improve, manage, and continue the provision of care at home.

5. Conclusion

Caregivers caring for care recipients who were unstable and bedridden had the highest risk of sleep dissatisfaction. Caregivers caring for care recipients who needed daily help because of severe dementia but whose physical abilities were unaffected had the second highest risk of sleep dissatisfaction. When care recipients could not leave their bed without help, their caregivers had a slight risk of sleep dissatisfaction, regardless of the recipient's dementia and need for care. Although many recent studies have found a greater prevalence of insomnia among older people, describing the characteristics of caregivers who are most likely to experience sleep dissatisfaction is a significant challenge. When care recipients were physically independent, the severity of the recipient's dementia symptoms was related to the caregiver's dissatisfaction with his/her sleep. Among physically dependent care recipients, the severity of the recipient's dementia did not contribute to the caregiver's dissatisfaction with his/her sleep.

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