

# Predictors of potentially harmful behaviour by family caregivers towards patients treated for behavioural and psychological symptoms of dementia in Japan

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**Title:**

Predictors of potentially harmful behaviour by family caregivers towards patients treated for behavioural and psychological symptoms of dementia in Japan

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## **Abstract**

**Background:** Potentially harmful behaviour (PHB) by caregivers is detrimental to the physical and psychological well-being of care recipients. In Japan, few studies have investigated caregivers' PHB towards dementia patients. This study examined PHB in family caregivers of dementia patients with behavioural and psychological symptoms of dementia (BPSD) and identified factors related to PHB.

**Methods:** Following primary consultations at an elderly psychiatric patient department, we enrolled 133 pairs of dementia patients and their family caregivers. We assessed PHB using the Japanese version of the modified Conflict Tactics Scale. We defined the presence of PHB as 2 or more points (PHB frequency of 'sometimes' or more) on at least one indicator on the modified Conflict Tactics Scale. We investigated the prevalence of PHB in relation to the clinical characteristics of the patients and their family caregivers. We evaluated BPSD using the Neuropsychiatric Inventory and caregiver burden using the eight-item Japanese version of the Zarit Caregiver Burden Interview.

**Results:** Of the family caregivers, 48.9% showed PHB. Multivariate analysis identified the following association with PHB: caregiver's Zarit Caregiver Burden Interview total score (OR, 1.09 per unit increase; 95% CI, 1.02–1.16),

and Neuropsychiatric Inventory scores for patient irritability (OR, 1.22 per unit increase; 95% CI, 1.06–1.40), appetite/eating disorders (OR, 1.41 per unit increase; 95% CI = 1.08–1.84) and daughters-in-law caregivers (odds ratio [OR], 0.17, 95% confidence interval [CI], 0.05–0.57).

**Conclusions:** Specific BPSD symptoms could contribute to the expression of PHB. In addition to decreasing caregiver burden, more intensive treatment and care strategies are required to manage individual symptoms.

**Key words:** abuse, behavioural and psychological symptoms of dementia, caregivers, dementia, potentially harmful behaviour

## INTRODUCTION

Behavioural and psychological symptoms of dementia (BPSD) have been estimated to affect up to 90% of all dementia patients over the course of their illness <sup>1</sup> and are associated with poor outcomes, such as patient and caregiver distress <sup>1</sup>. Without accurate information about dementia and its care, such distress often produces negative feelings towards patients by caregivers, which can lead to inappropriate, or even abusive, caregiver behaviour. Such responses may lead to further deterioration in BPSD <sup>2</sup>.

Potentially harmful behaviour (PHB) is defined as behaviour that is detrimental to the physical and psychological well-being of the care recipient, though not necessarily severely abusive <sup>3-5</sup>. PHB includes poor-quality care, such as screaming and yelling, using a harsh tone of voice, and physically shaking the care recipient. Prevention strategies for PHB in dementia care and improving the patient-caregiver relationship may ameliorate BPSD. Thus, PHB screening, which allows medical staff to intervene and support caregivers, has recently become increasingly important.

In Asian societies, the family is the first line of support for older people. In Japan, as in other Asian countries, families traditionally place great emphasis on filial responsibilities <sup>6,7</sup>. Particularly in rural areas, residents

assume that elderly people should live with their families and be cared for by them. However, despite these social norms, few studies have investigated the appropriateness of familial care with respect to issues such as PHB. Kishimoto et al. <sup>8</sup> investigated the frequency of abusive behaviour and related factors among caregivers of elderly people with mild cognitive dysfunction. Sasaki et al. <sup>9</sup> reported factors related to PHB among family caregivers for disabled older users of visiting nursing services under the Japanese Long-Term Care Insurance System. However, no studies in Japan have focused only on PHB with BPSD patients, a high-risk population for PHB. The relationship between PHB and individual clusters of BPSD remains unclear.

The present study had two aims. The first was to investigate the frequency and type of PHB by family caregivers of BPSD patients visiting the outpatient clinic of a psychiatric hospital in rural Japan. The second was to identify aspects of both the patients' and family caregivers' clinical characteristics that were related to PHB.

## **METHODS**

### **Patients and ethical considerations**

The patients were aged 65 years or more and had primary consultations at

the elderly psychiatric patient department of Ishikawa Prefectural Takamatsu Hospital from July 2014 to June 2015. We also investigated patients' family caregivers (total, 147 participant pairs). The patients had no prior experience of psychiatric treatment. A diagnosis of dementia was made under the supervision of experienced geriatric psychiatrists according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (Text Revision)* <sup>10</sup>. All patients with dementia with Lewy bodies (DLB) met the criteria for probable DLB formulated by McKeith <sup>11</sup>. The diagnosis was based on interviews with patients and family caregivers as well as on neurological findings, laboratory data, and brain imaging. We excluded caregivers who had been cited for abuse by a public institution.

This research was conducted with the approval of the Kanazawa University Medical Ethics Review Committee (No. 519). This study was performed in accordance with the ethical standards established by the Declaration of Helsinki (as revised in Brazil, 2013).

## **Procedure**

We provided patients and family caregivers with oral and written explanations of the research objectives, methods, and ethical considerations. We received written informed consent to participate from family caregivers.



## Measures

### Patient variables

We examined patient demographics: age, sex, type of dementia, educational achievement, cohabitants, physical disorder under treatment, cognitive function, BPSD, and activities of daily living (ADLs). We evaluated patient's cognitive function using the Mini Mental State Examination <sup>12</sup>, conducted by a psychiatrist.

BPSD was evaluated using the Neuropsychiatry Inventory (NPI)<sup>13</sup>. This scale evaluates 12 neuropsychiatric symptoms: delusions, hallucinations, agitation, depression, anxiety, euphoria, apathy, disinhibition, irritability, aberrant motor behaviour, sleep and night-time behaviour disorders, and appetite/eating disorders. We evaluated the presence or absence of symptoms for each item using information from caregivers. The frequency of the applicable symptoms is rated from 1 to 4 and symptom severity from 1 to 3. The NPI score is calculated by multiplying the frequency and severity. If there are no applicable symptoms, the score is 0; the highest possible score is 144. Higher scores indicate more severe BPSD.

We measured patient ADLs using the Nishimura Activity of Daily Living Scale <sup>14</sup>. This is one of the most commonly used ADL scales in Japan.

We classified daily living ability according to five items: walking/sitting, living area, putting on and taking off clothes and bathing, feeding, and excretion. Each item is rated on a scale of 0–10. Item scores are summed, and the total possible score is 50. Higher scores indicate greater daily living ability.

### **Caregiver variables**

The family caregiver's demographics included age, sex, relationship to the patient, mental/physical disorder under treatment, and work. We obtained information about the following: presence of family members requiring nursing care in addition to the participating patient, presence of family caregivers in addition to the participating caregiver, existence of formal staff for caregiver consultation, hours per week caregivers spent with the patient, length of time the caregiver had been caring for the patient (months), and patient income per month. Caregivers were asked to complete questionnaires related to PHB, caregiver burden, and their own physical and mental state of health using the following measures.

We measured PHB using the 10-items m-CTS <sup>4</sup>, which is based on the Conflict Tactics Scale <sup>15</sup>. We used the Japanese version of the m-CTS <sup>8</sup>. The m-CTS includes five indicators of psychological mistreatment: screaming

and yelling; threatening with nursing home placement; threatening with physical force; threatening to abandon; and verbal abuse, which includes using a harsh tone of voice, insults, name calling, and swearing. The m-CTS includes five indicators of physical mistreatment: withholding food; hitting or slapping the care recipient; shaking the recipient; handling the recipient roughly in other ways; and the caregiver's fear that they might hit or try to hurt the recipient. We examined PHB for the most recent month. Each item was scored from 0 to 4: 0 (never), 1 (almost never), 2 (sometimes), 3 (most of the time), and 4 (all the time). The total possible score was 40 points. Cronbach's coefficient  $\alpha$  was 0.842 for the 10 m-CTS items, 0.798 for the five indicators of psychological mistreatment, and 0.748 for the five indicators of physical mistreatment. Both subscales showed acceptable internal consistency.

We assessed feelings of nursing care burden using the eight-item Japanese version of the Zarit Caregiver Burden Interview (J-ZBI-8)<sup>16,17</sup>. The Zarit Caregiver Burden Interview is a scale that objectively measures caregivers' sense of the care burden. Each item is rated on a five-point Likert scale from 0 (never) to 4 (nearly always). The maximum score is 32; higher scores indicate a greater feeling of care burden. Cronbach's coefficient  $\alpha$  for the J-ZBI-8 was 0.751.

We examined the physical component summary (PCS) and mental component summary (MCS) of health-related quality of life (HRQOL) using the Short Form Health Survey, eight-item version (SF-8)<sup>18</sup>. The SF-8 comprises eight items with a five- or six-point response range. It measures two components of HRQOL: the PCS and the MCS. The SF-8 scales are scored using norm-based methods; the mean PCS and MCS scores are 50, with a standard deviation of 10. Higher scores indicate better HRQOL. Cronbach's coefficient  $\alpha$  for the SF-8 was 0.873.

### **Data analysis**

The primary outcome variable was the presence of PHB, which we defined as two or more points (PHB frequency of 'sometimes' or more) on at least one indicator of the 10 m-CTS. This definition was based on the assumption by Beach et al. that a PHB frequency of 'sometimes' is a more clinically significant threshold than a frequency of 'almost never'<sup>4</sup>.

In the descriptive analysis, we evaluated differences between the groups (PHB versus non-PHB) using the  $\chi^2$ , Fisher's exact test, and  $t$  tests. To determine independent predictors of PHB, we used a stepwise multivariate logistic regression model, which included variables significant in the descriptive analysis. To confirm multicollinearity, we calculated the

Pearson correlation coefficient for independent variables. SPSS Statistics, version 23.0 (IBM, Armonk, NY, USA) was used for statistical calculations. A two-tailed  $P < 0.05$  was considered significant.

## **RESULTS**

### **Characteristics of dementia patients and family caregivers**

From the 147 family caregivers, we received 135 responses (response rate, 91.8%). We excluded two responses with missing data (valid response rate, 98.5%). Thus, we included 133 responses in the analysis (Table 1).

### **Frequency and type of PHB**

We classified 65 caregivers (48.9%) into the PHB group. The most frequent score was 0 (24.8%); the median m-CTS score was 2 (range, 0–24). Table 2 shows the prevalence of PHB for individual indicators of the m-CTS. Screaming and yelling at the care recipient was the most common behaviour.

### **Factors affecting PHB**

Regarding the family caregiver's relationship to the patient, there were more sons in the PHB group than in the non-PHB group. There were fewer

daughters-in-law in the PHB group than in the non-PHB group (Table 1). The Mini Mental State Examination and Nishimura Activity of Daily Living Scale scores were lower in the PHB group than in the non-PHB group. The total NPI score was higher in the PHB group than in the non-PHB group. Regarding the individual subitems, the PHB group scored higher on agitation, apathy, irritability, aberrant motor behaviour, sleep and nighttime behaviour disorders, and appetite and eating disorders (Table 3). The total J-ZBI-8 score for caregivers in the PHB group was higher than in the non-PHB group. The MCS scores for HRQOL in the PHB group were lower than in the non-PHB group (Table 4).

The multivariate analysis confirmed multiple collinearity; patient agitation and irritability scores on the NPI were positively correlated ( $r = 0.69$ ,  $P < 0.001$ ). The J-ZBI-8 and MCS scores for caregivers were negatively correlated ( $r = -0.68$ ,  $P < 0.001$ ). We excluded agitation and MCS because the relationship between abuse of elderly people and irritability and caregiver burden has previously been reported <sup>19</sup>. Multivariate analysis identified the following associations: daughters-in-law caregiver, higher caregiver J-ZBI-8 total score, patient irritability, and appetite/eating disorders were independent predictors of PHB. The discriminant predictive value of this model was 72.9% (Table 5).

## DISCUSSION

### Frequency and type of family caregiver PHB

The incidence of PHB towards dementia patients seems to vary by country and study population. We found that almost half the family caregivers of the patients who initially received psychiatric outpatient consultation for BPSD had expressed PHB. According to Beach et al. <sup>4</sup>, 26% of family caregivers express PHB towards elderly patients with declining or instrumental ADLs requiring long-term care. In Japan, Sasaki et al. <sup>9</sup> reported that PHB occurred in 30% of family caregivers of elderly people with physical disabilities who received visiting nursing services. Kishimoto et al.<sup>8</sup> examined the incidence of abusive behaviour (their definition of this was identical to the definition of PHB in our study) in caregivers of elderly people with mild cognitive impairment. They reported similar findings to our own: screaming or yelling at the care recipient, and using a harsh tone of voice were the most common types of abusive behaviour. The total incidence of abusive behaviour, however, was only 15.4%. The higher frequency of PHB in the present study suggests that caring for dementia patients who require psychiatric treatment for worsening BPSD constitutes a high risk for PHB. However, simple comparisons among studies should be

made with caution, because definitions of PHB and survey methods differ <sup>4,9</sup>.

### **Factors related to family caregiver PHB**

Multivariate analysis identified the following independent predictors of PHB: higher family caregiver burden; having a family caregiver who was not a daughter-in-law; and patient BPSD symptoms of irritability and appetite/eating disorders. This finding of the relationship between caregiver burden and PHB or abusive behaviour is consistent with the results of previous studies <sup>8,20-22</sup>. Research shows that providing educational interventions for problem-solving skills and knowledge of dementia, social resources, and emotional support or enhanced counselling is effective in decreasing caregiver burden <sup>23</sup>.

Previous findings on the association between the caregiver relationship to the PHB patient and abusive behaviour are conflicting <sup>4,8,9,19</sup>. Several Japanese studies have revealed that daughters-in-law are more likely to experience distress in caregiving <sup>24,25</sup>; however, our findings indicate that daughters-in-law are less likely to express PHB. It is possible that daughters-in-law tend to conceal the incidence of PHB when completing the m-CTS. Alternatively, they may suppress their negative feelings in front of the patient, whereas blood relatives may unreservedly express their



emotions. In contrast to our findings, Mattoo et al.<sup>26</sup> reported that the incidence of abusive behaviour by daughters-in-law in India was about the same as that for sons. Little research has addressed this point, so more studies are needed.

Previous investigations have identified an association between severe BPSD and abusive acts; however, most studies have reported total NPI scores<sup>8,19</sup>. The present study, which examined the relationship between PHB and individual NPI symptoms, may help to identify more specific strategies to address PHB. Our findings on the relationship between PHB and irritability are consistent with those of a study on abusive behaviour by Cooper et al.<sup>19</sup> in England. Irritability is an early symptom of Alzheimer's disease<sup>27</sup> and occurs in 36% of patients<sup>28</sup>. Because it is often expressed as a hostile attitude to others, it could easily provoke caregivers to engage in PHB.

One novel finding of the present study is the relationship between appetite/eating behaviour abnormalities and caregiver PHB. We suggest that caregivers may excessively coerce patients to eat if they are less responsive when served food. Appetite and eating disorders are as common as irritability among Alzheimer's disease patients<sup>28</sup>. Symptoms such as overeating, food refusal, and weight loss appear to develop along with

dementia progression in Alzheimer's disease<sup>29,30</sup>. Individuals with DLB can present appetite loss owing to psychiatric symptoms as well as difficulty in swallowing because of parkinsonism<sup>31</sup>. Various factors, such as food environment, patient's swallowing function<sup>32,33</sup>, taste sensations<sup>34</sup>, and olfaction<sup>35</sup>, can affect appetite and eating disorders in dementia. Concomitant with medical interventions, caregivers should receive accurate information about the cause of symptoms and appropriate care.

### **Limitations**

Because this was a cross-sectional study, we cannot assume any causality in the association between PHB and BPSD. Longitudinal studies are needed to clarify the association among the relevant factors. In addition, the association between PHB and BPSD may differ depending on type of dementia. Further research with sufficiently large samples is needed to address this point. We conducted this investigation at a single facility in Japan, so the generalizability of our results is limited. Our findings need to be verified through additional studies in other facilities and areas.

### **Conclusions**

This is the first study in Japan to investigate PHB in family caregivers of

dementia patients with BPSD and the relationship of PHB with individual symptoms. We found that PHB was relatively prevalent among caregivers of BPSD patients. In addition to caregiver burden and caregiver–patient relationship, patient irritability and appetite and eating disorders are associated with caregiver PHB. More intensive pharmacological and non-pharmacological treatment of patients, as well as care and educational strategies for caregivers, are required. Further studies are necessary to clarify the factors related to PHB; the implementation of optimal strategies in earlier stages of dementia could be effective in preventing further deterioration of BPSD.

#### **ACKNOWLEDGMENTS**

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#### **DISCLOSURE**

The authors have no conflicts of interest to disclose.

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Table 1. Association between dementia patient and caregiver characteristics and potentially harmful caregiver behaviour

	All (N = 133)	PHB group (n = 65)	Non-PHB group (n = 68)	Test statistic	<i>P</i> value
<b>Patients</b>					
Age (years) †	82.0±6.0	82.8±5.4	81.3±6.6	<i>t</i> = -1.354	0.178
Sex ‡				$\chi^2 = 0.843$	0.359
Male	50(37.6)	27(41.5)	23(33.8)		
Female	83(62.4)	38(58.5)	45(66.2)		
Type of dementia ‡				$\chi^2 = 0.947$	0.623
AD	96(72.2)	47(72.3)	49(72.1)		
DLB	26(19.5)	14(21.5)	12(17.6)		
Other (VD, FTD, PDD)	11(8.3)	4(6.2)	7(10.3)		
Educational achievement ‡				$\chi^2 = 2.204$	0.332
Primary school	53(39.8)	23(35.4)	30(44.1)		
Middle school	45(33.8)	26(40.0)	19(27.9)		
Other	35(26.3)	16(24.6)	19(27.9)		
Patient living ‡				$\chi^2 = 1.506$	0.471
Alone	14(10.5)	9(13.8)	5(7.4)		
With partner only	24(18.0)	11(16.9)	13(19.1)		
With others	95(71.4)	45(69.2)	50(73.5)		
Physical disorder under treatment §	126(94.7)	63 (96.9)	63(92.6)		0.239
<b>Caregivers</b>					
Age (years) †	61.6±11.6	63.1±11.0	60.1±12.1	<i>t</i> = -1.452	0.149
Sex ‡				$\chi^2 = 0.847$	0.357
Male	44(33.1)	24(36.9)	20(29.4)		
Female	89(66.9)	41(63.1)	48(70.6)		
Relationship to patient ‡				$\chi^2 = 11.736$	0.019 *
Wife	23(17.3)	14(21.5)	9(13.2)		
Son	29(21.8)	<u>19(29.2)</u>	10(14.7)		
Daughter	35(26.3)	18(27.7)	17(25.0)		
Daughter-in-law	28(21.1)	7(10.8)	<u>21(30.9)</u>		
Other	18(13.5)	7(10.8)	11(16.2)		
Mental disorder under treatment §	6(4.5)	3(4.6)	3(4.4)		0.638
Physical disorder under treatment ‡	85(63.9)	45(69.2)	40(58.8)	$\chi^2 = 1.561$	0.212
Working ‡				$\chi^2 = 1.255$	0.534
Full-time	39(29.3)	17(26.2)	22(32.4)		
Part-time	35(26.3)	16(24.6)	19(27.9)		
No	59(44.4)	32(49.2)	27(39.7)		

Data are given as means ± SD or as the number of subjects in each group with percentages in parenthesis as appropriate.

†Student *t* test. ‡ $\chi^2$  test. §Fisher's exact test. \* *P* < 0.05.

Underlined values were significant in the residual analysis; adjusted standardization residual absolute value >1.96; *P* < 0.05.

PHB, potentially harmful behaviour; AD, Alzheimer's disease; DLB, dementia with Lewy bodies; VD, vascular dementia; FTD, frontotemporal dementia; PDD, Parkinson's disease dementia.

Table 2. Prevalence of family caregiver potentially harmful behaviour (PHB; score of  $\geq 2$  on PHB indicators; N = 133)

Caregiver behaviour (multiple answers)	n <sup>†</sup> <sub><math>\geq</math>score 2</sub>	%
1. Screamed or yelled at care recipient	52	39.1
2. Used harsh tone of voice	36	27.1
3. Threatened to send care recipient to care home	14	10.5
4. Threatened to stop taking care of or abandon care recipient	8	6
5. Threatened to use physical force on care recipient	7	5.3
6. Carer afraid they might hit or hurt care recipient	13	9.8
7. Withheld food from care recipient	0	0
8. Hit or slapped care recipient	4	3
9. Shaken care recipient	6	4.5
10. Otherwise handled care recipient roughly	2	1.5

<sup>†</sup>Number of care recipients reporting that the caregiver exhibited the behaviour sometimes, most of the time, or all of the time (versus never or almost never).

PHB, potentially harmful behaviour.

Table 3. Cognitive symptoms, behavioural and psychological symptoms of dementia, and activities of daily living in dementia patients in two potentially harmful behaviour groups

	All (N = 133)	PHB group (n = 65)	Non-PHB group (n = 68)	Test statistic	<i>P</i> value
MMSE score (0–30) †	15.1±7.2	13.4±7.8	16.8±6.2	$t = 2.722$	0.007 **
NPI total score (0–144) †	22.9±17.5	29.6±18.6	16.4±13.8	$t = -4.615$	0.000 ***
NPI items (0–12)					
Delusions ‡	1.7±3.4	2.0±3.6	1.5±3.1	$t = -0.752$	0.454
Hallucinations ‡	1.8±3.6	1.9±3.7	1.7±3.4	$t = -0.423$	0.673
Agitation †	3.4±3.9	4.5±4.2	2.3±3.2	$t = -3.441$	0.001 **
Depression †	1.1±2.4	1.5±2.8	0.8±2.0	$t = -1.485$	0.140
Anxiety †	1.7±3.1	2.1±3.7	1.3±2.5	$t = -1.457$	0.148
Euphoria ‡	0.3±1.4	0.3±1.1	0.4±1.6	$t = 0.376$	0.707
Apathy ‡	2.9±3.3	3.5±3.5	2.3±3.0	$t = -2.105$	0.037 *
Disinhibition ‡	1.2±2.7	1.3±3.0	1.0±2.3	$t = -0.763$	0.447
Irritability †	2.8±3.4	3.8±3.8	1.7±2.7	$t = -3.727$	0.000 ***
Aberrant motor behaviour †	2.1±3.5	2.7±3.8	1.5±3.2	$t = -1.996$	0.048 *
Sleep and night-time behaviour disorders †	2.7±3.9	3.8±4.6	1.6±2.7	$t = -3.284$	0.001 **
Appetite and eating disorders †	1.2±2.9	2.2±3.7	0.3±1.2	$t = -3.894$	0.000 ***
N-ADL score (0–50) †	38.1±10.2	35.0±11.1	41.1±8.4	$t = 3.543$	0.001 **

Data are given as means ± SD.

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

†Welch's *t* test. ‡Student's *t* test.

PHB, potentially harmful behaviour; MMSE, Mini-Mental State Examination; NPI, Neuropsychiatric Inventory; N-ADL, Nishimura Activity of Daily Living Scale.

Table 4. Family caregiver nursing situation, caregiver burden, and health-related quality of life in two potentially harmful behaviour groups

Variables	All (N = 133)	PHB group (n = 65)	Non-PHB group (n = 68)	Test statistic	<i>P</i> value
Existence of additional family members requiring nursing care †	17(12.8)	6(9.2)	11(16.2)	$\chi^2 = 1.438$	0.230
Existence of additional family caregivers ‡	63(47.4)	34(52.3)	34(50.0)	$\chi^2 = 1.244$	0.265
Existence of formal staff for caregiver to consult ‡	115(86.5)	59(90.8)	56(82.4)	$\chi^2 = 2.012$	0.156
Amount of time caregivers spent with patient (hours/week) §	79.1±59.9	81.5±60.1	76.9±60.1	$t = -0.440$	0.660
Duration of caregiving (months) §	31.3±38.5	34.2±34.8	28.5±41.7	$t = -0.840$	0.402
Patient income per month (10,000 yen) †, §	12.3±6.4	12.5±6.0	12.0±6.8	$t = -0.414$	0.680
J-ZBI-8 score (0–32) §	13.1±7.4	15.9±7.2	10.5±6.6	$t = -4.512$	0.000 ***
SF-8 §					
PCS	48.2±8.2	47.4±8.4	49.0±8.0	$t = 1.137$	0.258
MCS	42.8±7.8	40.5±7.3	45.0±7.7	$t = 3.444$	0.001 ***

Data are given as means ± SD or as the number of subjects in each group with percentages in parenthesis as appropriate.

\*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

†This variable had missing values; all  $n = 100$ , PHB group  $n = 51$ , non-PHB group  $n = 49$ .

‡ $\chi^2$  test, §Student's  $t$  test.

PHB, potentially harmful behaviour; J-ZBI-8, short version of the Zarit Caregiver Burden Interview scale, Japanese version; SF-8, Short Form Health Survey 8-item version; PCS, physical component summary; MCS, mental component summary.

Table 5. Result of binomial logistic regression analysis with family caregiver potentially harmful behaviour (PHB; 1 = PHB group, 0 = non-PHB group) as the dependent variable (N = 133)

Variables	Odds ratio	95% confidence intervals	<i>P</i> value
NPI: irritability (per unit increase)	1.22	1.06–1.40	0.004 **
NPI: appetite and eating disorders (per unit increase)	1.41	1.08–1.84	0.011 *
J-ZBI-8 score (per unit increase)	1.09	1.02–1.16	0.012 *
Caregiver's relationship: daughter-in-law	0.17	0.05–0.57	0.004 **

\**P* < 0.05, \*\**P* < 0.01.

Distinction hitting ratio: 72.9%, model  $\chi^2$ , *P* < 0.01,

Hosmer–Lemeshow test: *P* = 0.734.

NPI, Neuropsychiatric Inventory; J-ZBI-8, short version of the Zarit Caregiver Burden Interview scale.