International Journal of Gerontology Special Issue (2019) S18–S22
https://doi.org/10.6890/IJGE.201910/SP.0002

International Journal of Gerontology

journal homepage: http://www.sgecm.org.tw/ijge/

Special Issue

Behavioral and Psychological Symptoms of Dementia Influencing Care Dependency of Older People with Dementia in Geriatric Residential Facilities in Japan

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ARTICLE INFO

Accepted 6 July 2019

Keywords:
behavioral and psychological symptoms of dementia,
care dependency,
geriatric residential facilities,
older people with dementia

SUMMARY

Background: This study aimed to clarify how cognitive function, activities of daily living (ADL), and behavioral and psychological symptoms of dementia (BPSD) influence care dependency of older people with dementia in geriatric residential facilities.
Methods: The participants were 376 older people diagnosed with dementia who were evaluated using ADL, Mini-Mental State Examination (MMSE), Neuropsychiatric Inventory (NPI), and Japanese Care Dependency Scale (CDS-J) scores.
Results: A multiple regression analysis with each subscale of the CDS-J as a dependent variable showed significant associations with the subscales of ADL, MMSE, and NPI. The language subscale of the MMSE was significantly positively associated with nine items from the 15 CDS-J subscales such as eating/drinking and incontinence. Additionally, apathy scores on the NPI subscale were significantly negatively associated with almost all CDS-J subscales.
Conclusion: These findings suggest that ADL, cognitive function, and BPSD such as apathy influence care dependence of older people with dementia. Previous research has shown that apathy can lead to deterioration of dementia. Healthcare providers should be encouraged to incorporate interest and intellectual stimulation into daily care in order to reduce apathy.

1. Introduction

Almost 9.9 million people develop dementia annually; it is the second largest cause of disability among individuals aged 70 years and older, and the seventh leading cause of death.[1] The aging rate in Japan was 27.7% in 2017 and is estimated to reach 39.9% by 2060, demonstrating that ultra-aging in Japan is remarkable compared to that in other nations.[2] Additionally, the number of older people with dementia has increased and, in June 2013, the Ministry of Health, Labour and Welfare estimated that there were 4.62 million older people with dementia in Japan.[2] There have been reports describing an increase in the burden of care for older people with dementia once the behavioral and psychological symptoms of dementia (BPSD) emerge, reducing the quality of life of both older people and their caregivers.[3] Recently, BPSD have been receiving attention for their relational factors, and it has been suggested that BPSD are related to decreasing levels of not only activities of daily living (ADL) but also self-autonomy, and that they lead to care dependency in the process of exacerbating dementia. Furthermore, BPSD are related to difficulties and dependence on assistance in ADL and everyday function,[4] while declines in ADL and BPSD are accelerated by the exacerbation of cognitive symptoms. Additionally, BPSD have been shown to cause falls[5,6] in older people with dementia, but research has not clarified the relationship between care dependency, BPSD, ADL, and cognitive function.

Care dependency implies that the self-care abilities of individuals concerning their daily physical and psychosocial needs have decreased, making them dependent on caregiving.[7] The Care Dependency Scale (CDS) was developed by Dijkstra et al.[7–9] based on Henderson's basic nursing needs.[10] In Japan, the reliability and validity of Japanese Care Dependency Scale (CDS-J) have been verified by Suzuki and colleagues.[11] For older people with dementia, it speculated that care dependency involves not only ADL and lack of self-care but also reduced autonomy since cognitive function and BPSD inhibit autonomy in complex interactions. We hypothesized that BPSD deeply affect executive function including disturbance in attention and understanding among older people with dementia, and these situations lead to the development of behavioral disorders and finally, dependence. Identifying these relationships would clarify the factors necessary to promote the autonomy of older people with dementia.

Therefore, the purpose of this study was to clarify how BPSD influence care dependency among older people with dementia living in geriatric residential facilities in Japan by controlling for confounding factors such as cognitive function and ADL, and the variables of age, dementia type, and BPSD therapeutic drugs through multiple regression analysis.

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2. Methods

This study was conducted between September 2013 and October 2015. The participants were older people who had been diagnosed with dementia and were receiving care in geriatric residential facilities in Japan. The nurses in charge of primary care, who were trained to assist in this research study, evaluated the participants using the Mini-Mental State Examination (MMSE), ADL scores, and other evaluation measures.

2.1. Ethical considerations

The charge nurses were provided with an explanation regarding the purpose of the study and received training of approximately one hour in the application of the evaluation indices used in the study. Family caregivers of the older people with dementia provided written consent for participation. The data were managed according to strict regulations in the primary research representative's laboratory. Ethical approval for the study was granted by the Hamamatsu Medical College Research Ethical Review Board. The study procedures were conducted in accordance with the Declaration of Helsinki.

2.2. Participant evaluations

2.2.1. Participant characteristics

Data regarding age, sex, and dementia status were obtained from the participants' medical records by the nurses in charge.

2.2.2. MMSE

The MMSE is an interview-based screening tool that measures cognitive impairment through six subscales. Total scores on the index range from 0 to 30, and higher scores indicate better cognitive functioning.[12] The interviews were conducted by the nurses who provided care for the older people with dementia participating in the study, as well as one of the researchers, who is a nurse with extensive experience in cognitive assessments of dementia.

2.2.3. ADL

Participants' independence with respect to bathing, dressing, continence, transferring (walking), and feeding was assessed using a three-point scale with the following response options: 1 = independent, 2 = limited assistance required, and 3 = extensive assistance required.[11] Higher scores indicated poorer performance in ADL.[13]

2.2.4. Neuropsychiatric Inventory

The Neuropsychiatric Inventory (NPI) consists of 12 items and measures dementia-related behavioral symptoms. Each item is assessed by calculating the product of frequency (measured using a five-point scale ranging from 0 to 4), multiplied by severity (measured using a four-point scale ranging from 0 to 3) and caregiver distress (measured using a six-point scale ranging from 0 to 5). Higher scores indicate more severe psychological symptoms.[14]

2.2.5. The CDS-J

The CDS-J is used to measure care dependency in people with dementia and other psychological disorders.[7,8,10] The CDS has 15 subscales, including eating/drinking, continence, body posture, mobility, day/night pattern, getting (un)dressed, body temperature, hygiene, avoidance of danger, communication, contact with others, sense of rules/values, daily activities, recreational activities, learning ability, general evaluation, and comprehensive evaluation.[7,8,10] Each subscale of the CDS-J is scored using a five-point scale ranging from completely dependent (1) to completely independent (5). The total score represents the extent of care required.

2.3. Statistical analysis

In the statistical analysis, the multiple regression analysis model was developed using the stepwise method with the CDS-J subscale scores as the dependent variables and ADL, MMSE, and NPI subscales as the independent variables. Correlation coefficients were calculated between the CDS-J subscales as dependent variables prior to the multiple regression analysis. If correlation coefficients were significant, the variable was excluded from the multiple regression analysis to ensure the absence of multicollinearity. Next, the multiple regression analyses were conducted, producing a model in which the extracted independent variables from the stepwise method were included, simultaneously controlling for age (age = continuous variable), dementia type (Alzheimer's = 1, vascular = 2, dementia with Lewy bodies = 3, frontotemporal = 4, mixed = 5), and BPSD drugs (yes = 1, no = 0). The statistical analysis was calculated using IBM SPSS version 25.

3. Results

Table 1 shows the characteristics of the 376 participants (men: *n* = 82, 21.8%; women: *n* = 294, 78.2%). The mean duration of living in

Table 1
Characteristics of the paticipants (n = 376).

Category	Number of persons	%
Types of dementia		
Alzheimer-type dementia	216	(57.45)
Vascular dementia	73	(19.41)
Lewy body dementia	10	(2.66)
Frontotemporal dementia	12	(3.19)
Mixed type dementia	65	(17.29)
Total	376	(100.00)
Pharmacological treatment		
Anti-dementia drugs[1)]		
Yes	40	(10.64)
No	356	(94.68)
Total	376	(100.00)
BPSD drugs[2)]		
Yes	203	(53.99)
No	173	(46.01)
Total	376	(100.00)
Physical function		
Joint contracture		
Yes	142	(37.77)
No	234	(62.23)
Total	376	(100.00)
Musculoskeletal paralysis		
Yes	76	(20.21)
No	300	(79/79)
Total	376	(100.00)
Hearing loss		
Yes	120	(31.91)
No	256	(68.09)
Total	376	(100.00)
Aphasia		
Yes	58	(15.43)
No	318	(84.57)
Total	376	(100.00)

[1)] Anti-dementia including drugs donepezil, galantamine, memantine, and rivastigmine.
[2)] BPSD drugs antipsychotic agents, antidepressants, sedative and hypnotic agents, mood stabilizers, cholinesterase inhibitors, and amantadine.

geriatric residential facilities was 27.44 ± 24.45 months. They had been diagnosed with several different types of dementia, including Alzheimer's disease (*n* = 216, 57.45%), vascular dementia (*n* = 73, 19.41%), dementia with Lewy bodies (*n* = 10, 2.66%), and frontotemporal dementia (*n* = 12, 3.19%). Additionally, 203 participants (53.99%) had been prescribed psychotropic drugs. Regarding physical function, 142 participants (37.77%) experienced joint contracture and 120 (31.91%) experienced hearing loss.

The mean ADL, MMSE, CDS-J, and NPI scores are shown in Table 2. The mean MMSE score was 8.24 ± 8.13. For the ADL, the highest score on any scale was for bathing (2.81 ± 0.46) and the lowest was for transferring (1.95 ± 0.71). Regarding the CDS-J, the score for communication showed the greatest impairments (2.84 ± 1.44), followed by scores for day/night pattern (2.57 ± 1.17) and eating/drinking (2.37 ± 1.35). For the NPI, the score for agitation was the highest (2.19 ± 3.19), indicating the greatest frequency and severity, followed by the scores for apathy (2.05 ± 3.09) and night-time behavior (1.54 ± 2.67).

Table 3 shows the results of a multiple regression analysis with the CDS-J subscale scores as the dependent variables. In the multiple regression analysis model, the CDS-J items of eating/drinking, continence, body posture, mobility, getting (un)dressed, body temperature, hygiene, and avoidance of danger were significantly positively associated with each subscale of the ADL. For the NPI, the "appetite and eating disorder" subscale was significantly negatively associated with eating/drinking and night-time behaviors, which was related to a significantly reduced day/night pattern. The NPI subscale of apathy and disinhibition was significantly negatively associated with the other items of the CDS-J, excluding eating/drinking and day/night pattern. Among the subscales of the MMSE, visual constitution (double-pentagon copy) was significantly positively associated with avoidance of danger, while orientation was significantly positively associated with day/night pattern, body temperature, and hygiene.

4. Discussion

This study aimed to clarify how ADL, BPSD, and cognitive function influence care dependency in older people with dementia living in geriatric residential facilities in Japan and who are covered by long-term care insurance. The participants' mean age was 85 years, and many had been diagnosed with moderate to severe dementia, necessitating partial or total assistance with ADL. The CDS-J items with comparatively high mean scores included communication and contact with others, indicating that exchanges with other older residents and healthcare providers increased for them. The CDS-J involved self-autonomy from the related area to social autonomy, and it was suggested that communication competence is more likely to be maintained by support from healthcare providers in geriatric residential facilities.

Although ADL subscale scores such as transferring were also comparatively higher than that of others, almost all the ADL subscales demonstrated that the older people required some assistance in this aspect.

The multiple regression analysis with CDS-J scores as dependent variables was conducted to clarify the role of the subscales of ADL, MMSE, and BPSD in relation to the subscales of the CDS-J. The multiple regression analysis showed that ADL subscale scores were significantly negatively associated with all CDS-J subscale scores. In the multiple regression analysis model, eating/drinking, continence, body posture, mobility, getting (un)dressed, body temperature, hygiene, and avoidance of danger were significantly positively associated with the ADL subscales, including feeding, continence, transferring, and dressing, respectively. Although the CDS-J evaluates care dependency, these findings indicated that basic ADL appear to be the foundation of the CDS-J as they reflect physical functioning. Higher scores on the CDS subscales, including contact with others, daily activities, recreational activities, and learning ability, were significantly negatively associated with continence. It has been reported that the prevalence of risk factors for incontinence in long-term care and community settings, including cognitive impairment, limitations in daily activities, and prolonged institutionalization in nursing homes, are associated with the likelihood of incontinence.[15] In this study, it was suggested that incontinence may be related to limited interactive activities in social life in older people with dementia.

Table 2
Means of ADL, MMSE, CDS and NPI.

Category	Means	SD
Age	85.92	6.94
Activities of daily living (ADL)[1]		
Bathing (1–3)*	2.81	0.46
Dressing (1–3)	2.64	0.75
Toileting (1–3)	2.33	0.74
Transferring (1–3)	1.95	0.71
Continence (1–3)	2.47	0.72
Feeding (1–3)	2.13	0.83
Mini-Mental State Examination (MMSE) (total) (0–30)[2]	8.24	8.13
Orientation (0–10)	1.93	2.68
Registration(0–3)	1.59	1.38
Attention and calculation (0–5)	0.63	1.21
Recall (0–3)	0.47	0.89
Language (0–8)	3.44	3.12
Visual constitution (0–1)	0.19	0.39
Japanese Care Dependency Scale (CDS-J)[3]		
Eating and drinking (1–5)	2.37	1.35
Continence (1–5)	2.25	1.41
Body posture (1–5)	2.31	1.42
Mobility (1–5)	2.00	1.43
Day/night pattern (1–5)	2.57	1.17
Getting dressed and getting undressed (1–5)	1.99	1.40
Body temperature (1–5)	2.22	1.09
Hygiene (1–5)	1.88	1.25
Avoidance of danger (1–5)	1.79	1.11
Communication (1–5)	2.84	1.44
Contact with others (1–5)	2.22	1.21
Sense of rules and values (1–5)	2.14	1.36
Daily activities (1–5)	1.91	1.17
Recreational activities (1–5)	1.46	0.86
Learning activities (1–5)	1.73	1.01
Comprehensive evaluation (1–5)	1.93	0.96
Neuropsychiatric Inventory (NPI) (frequency × severity)*[2]		
Delusions (1–12)	0.81	2.11
Hallucinations (1–12)	0.69	1.83
Agitation (1–12)	2.19	3.19
Depression (1–12)	0.55	1.49
Anxiety (1–12)	0.68	1.93
Euphoria (1–12)	0.20	0.91
Apathy (1–12)	2.05	3.09
Disinhibition (1–12)	0.73	1.94
Irritability (1–12)	1.38	2.72
Aberrant motor behavior (1–12)	1.04	2.21
Night-time behaviors (1–12)	1.54	2.67
Appetite and eating disorders (1–12)	1.29	2.88

* (maximum value-minimum value).
1: The score o f ADL is 1 (independence)–3 (dependence).
2: The score of the lower factor in CDS is 1 (dependence)–5(independence).
3: The score of NPI(I(frequency × severity) is 0 (non)–12 (very severe).

Table 3
Multiple regression analysis with the CDS-J subscale scores as the dependent variables.

Dependent variable	Indeependent variable	β	p value	Dependent variable	Indeependent variable	β	p value
1. Eating/drinking	Age[1]	0.084	0.010	**9. Avoidance of danger**	Age[1]	0.011	0.754
	Type of dementia[2]	-0.059	0.079		Type of dementia[2]	-0.051	0.169
	BPSD drugs[3]	0.036	0.279		BPSD drugs[3]	0.032	0.394
	ADL (Feeding)	-0.650	0.000		ADL (Dressing)	-0.543	0.000
	MMSE (Language)	0.156	0.000		MMSE (Visual constraction[4])	0.219	0.000
	NPI (Appetite/Eating)	-0.075	0.023		NPI (Apathy)	-0.143	0.000
Multiple correlation coefficient (R)		0.784		Multiple correlation coefficient (R)		0.722	
Coefficient of determination (R^2)		0.615		Coefficient of determination (R^2)		0.521	
2. Incontinence	Age[1]	0.031	0.293	**10. Communication**	Age[1]	0.028	0.429
	Type of dementia[2]	-0.048	0.102		Type of dementia[2]	-0.033	0.358
	BPSD drugs[3]	0.010	0.744		BPSD drugs[3]	0.101	0.006
	ADL (Toileting)	-0.651	0.000		ADL (Feeding)	-0.294	0.000
	MMSE (Language)	0.260	0.000		MMSE (Language)	0.429	0.000
	NPI (Disinhibition)	-0.110	0.000		NPI (Apathy)	-0.127	0.001
Multiple correlation coefficient (R)		0.835		Multiple correlation coefficient (R)		0.739	
Coefficient of determination (R^2)		0.697		Coefficient of determination (R^2)		0.546	
3. Body posture	Age[1]	0.010	0.739	**11. Contact with others**	Age[1]	0.054	0.139
	Type of dementia[2]	-0.042	0.192		Type of dementia[2]	-0.041	0.274
	BPSD drugs[3]	0.049	0.128		BPSD drugs[3]	0.036	0.338
	ADL (Toileting)	-0.623	0.000		ADL (Continence)	-0.313	0.000
	MMSE (Language)	0.250	0.000		MMSE (Language)	0.439	0.000
	NPI (Disinhibition)	-0.073	0.022		NPI (Apathy)	-0.089	0.022
Multiple correlation coefficient (R)		0.806		Multiple correlation coefficient (R)		0.733	
Coefficient of determination (R^2)		0.650		Coefficient of determination (R^2)		0.537	
4. Mobility	Age[1]	-0.018	0.630	**12. Sense of rules and values**	Age	0.073	0.076
	Type of dementia[2]	-0.001	0.982		Type of dementia	-0.024	0.567
	BPSD drugs[3]	0.026	0.503		BPSD drugs[3]	-0.005	0.896
	ADL (Transfering)	-0.571	0.000		ADL (Bathing)	-0.270	0.000
	MMSE (Language)	0.137	0.004		MMSE (Orientation)	0.391	0.000
	NPI (Apathy)	-0.091	0.022		NPI (Apathy)	-0.204	0.000
Multiple correlation coefficient (R)		0.701		Multiple correlation coefficient (R)		0.631	
Coefficient of determination (R^2)		0.491		Coefficient of determination (R^2)		0.399	
5. Day/night pattern	Age[1]	-0.043	0.264	**13. Daily activities**	Age[1]	0.012	0.721
	Type of dementia[2]	-0.060	0.121		Type of dementia[2]	-0.030	0.370
	BPSD drugs[3]	0.101	0.011		BPSD drug[3]	-0.034	0.326
	ADL (Feeding)	-0.471	0.000		ADL (Continence)	-0.506	0.000
	ADL (Bathing)	0.190	0.000		MMSE (Language)	0.312	0.000
	NPI (Nighttime Behavior)	-0.284	0.000		NPI (Apathy)	-0.108	0.002
Multiple correlation coefficient (R)		0.693		Multiple correlation coefficient (R)		0.774	
Coefficient of determination (R^2)		0.480		Coefficient of determination (R^2)		0.598	
6. Getting dressed and undressed	Age[1]	-0.057	0.165	**14. Recreational activities**	Age	0.068	0.106
	Type of dementia[2]	-0.064	0.125		Type of dementia	0.022	0.605
	BPSD drugs[3]	0.051	0.224		BPSD drug[3]	0.002	0.958
	ADL (Dressing)	-0.295	0.000		ADL (Continence)	-0.430	0.000
	MMSE (Language)	0.410	0.000		MMSE (Language)	0.209	0.000
	NPI (Apathy)	-0.004	0.920		NPI (Apathy)	-0.103	0.067
Multiple correlation coefficient (R)		0.627		Multiple correlation coefficient (R)		0.605	
Coefficient of determination (R^2)		0.393		Coefficient of determination (R^2)		0.366	
7. Body temperature	Age[1]	0.053	0.102	**15. Learning activity**	Age[1]	-0.022	0.583
	Type of dementia[2]	-0.007	0.820		Type of dementia[2]	-0.066	0.098
	BPSD drugs[3]	0.038	0.252		BPSD drug[3]	-0.100	0.013
	ADL (Dressing)	-0.654	0.000		ADL (Continence)	-0.371	0.000
	MMSE (Orientation)	0.157	0.000		MMSE (Language)	0.350	0.000
	NPI (Apathy)	-0.138	0.000		NPI (Apathy)	-0.084	0.044
Multiple correlation coefficient (R)		0.788		Multiple correlation coefficient (R)		0.669	
Coefficient of determination (R^2)		0.621		Coefficient of determination (R^2)		0.447	
8. Hygiene	Age[1]	0.078	0.034	**16. Comprehensive evaluation**	Age[1]	0.024	0.469
	Type of dementia[2]	-0.008	0.838		Type of dementia[2]	-0.067	0.045
	BPSD drugs[3]	-0.005	0.901		BPSD drug[3]	0.037	0.283
	ADL (Bathing)	-0.508	0.000		ADL (Continence)	-0.532	0.000
	MMSE (Orientation)	0.284	0.000		MMSE (Language)	0.244	0.000
	NPI (Apathy)	-0.156	0.000		NPI (Apathy)	-0.156	0.000
Multiple correlation coefficient (R)		0.717		Multiple correlation coefficient (R)		0.777	
Coefficient of determination (R^2)		0.514		Coefficient of determination (R^2)		0.603	

1: Age = continuous variable.
2: Type of dementia: Alzheimer's = 1, Vascular = 2, Lewy body Dementia = 3, Frontotemporal = 4, Mixed = 5).
3: BPSD drugs (yes = 1, no = 0).

In the multiple regression analysis using the CDS-J, eating and drinking scores were significantly negatively associated with scores on the NPI subscales of appetite, eating disorders, and night-time behavior in the day/night pattern. It is understandable that BPSD subscales such as appetite and eating disorders significantly reduced care dependency concerning eating and drinking, which is an important issue for older people with dementia as it affects the maintenance of physical functions involving nutrition and influences prognosis.[16] The finding that NPI night-time behavior was significantly correlated with the day/night pattern of care dependency is logical, and it has been suggested that night-time behavior is based on disorientation, which is associated with serious accidental falls at night.[17]

In the NPI, apathy and disinhibition significantly reduced independence, excluding eating/drinking and day/night pattern. Apathy, among the most common and persistent symptoms in older people with dementia, may reduce interest in their surroundings and may be associated with reduced performance of ADL. Apathy may also be associated with advanced dementia and lead to inactivity and disuse syndrome.[18] However, it was also reported that caregiving based on musical activities reduced apathy levels in older people with dementia,[19] and healthcare providers should be encouraged to incorporate interest and intellectual stimulation into daily care in order to reduce apathy.

In conclusion, BPSD such as apathy considerably influenced care dependency of older people with dementia after controlling for MMSE score in the first step, and age, dementia type, and BPSD drugs in the final step.

5. Limitations

This study had several limitations. It conducted the statistical analysis of data using multiple regression analysis with a cross-sectional design and a limited sample size in geriatric residential facilities in Japan. Thus, the results of this study may not be generalized to all older people with dementia. Therefore, longitudinal studies are needed to identify the nature of the relationship between BPSD and care dependency.

Acknowledgments

We would like to express our sincere appreciation to the participants and their family members for their understanding and cooperation. We also thank the managers and staff at each facility.

Funding/support statement

Part of the FY2013–2015 Research Funding for Longevity Sciences from National Center for Geriatrics & Gerontology "Research on verifying the effect of early intervention for BPSD in care facilities and general hospitals" was used to conduct the study (Principle investigator: Hideyuki Hattori).

Declaration of interest

Part of the FY2013–2015 Research Funding for Longevity Sciences from the National Center for Geriatrics & Gerontology's "Research on verifying the effect of early intervention for BPSD in care facilities and general hospitals" was used to conduct the study.

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