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Original Article

Oral Health Conditions in Patients with Parkinson's Disease

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BACKGROUND: Oral health conditions and related factors of patients with Parkinson's disease (PD) have not been well elucidated. The aim of the present study was to investigate oral health conditions and related factors which may influence oral health conditions among patients with PD.

METHODS: We compared oral health conditions and related factors between 104 PD patients and 191 inhabitants (controls) who received dental health check-ups in Hokkaido, Japan. The unconditional logistic regression model was used for adjusting for sex and age. We also conducted stratified analysis by sex and age group using this model. The χ^2 test and the Cochran-Mantel-Haenszel test were used for simple and stratified analyses of knowledge of oral health among PD patients, respectively.

RESULTS: In the present survey, we found the following results. (1) PD patients had more complaints of chewing difficulties and denture discomfort than controls. (2) Fewer PD patients had their own teeth than controls regardless of sex. (3) Fewer PD patients cleaned their dentures every day than controls, regardless of sex or age. (4) More than half of the PD patients had problems with swallowing.

CONCLUSION: We found that PD patients had more complaints about their oral health and more problems in oral health behavior than the general population. These findings may provide useful information for the caregivers of PD patients to conduct oral health care as well as for making oral health plans for PD patients and for medical and welfare services.

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Key words: Oral Health; Parkinson Disease; Dental Care; Deglutition Disorders; Pneumonia, Aspiration.

There is no established medical treatment to completely cure intractable diseases (i.e., Nanbyo in Japanese) because their etiologies remain unknown. Thus, patients with intractable diseases may suffer from disabilities even after treatment. As the clinical course is chronic, patients with intractable diseases need long-lasting medical treatment and care, which causes a heavy burden for the patients themselves as well as their family members, not only mentally but also financially.

Patients with Parkinson's disease (PD), which is one of the most common intractable diseases, suffer from disabilities of walking, eating, biting, swallowing, using the toilet, communicating, or respiration through muscle weakness, or disability of movement, in addition to abnormal eye symptoms and autonomic nervous system disorders.^{1,2} Patients with dysphagia, dental diseases and/or poor oral hygiene have been shown to have a high incidence of aspiration pneumonia,^{3,4} which may sometimes lead to death.^{5,9-11} Therefore, it is important for patients with neuro-

genic disorders to maintain good oral hygiene.

However, their oral health conditions and related factors, such as oral complaints, tooth brushing, condition of swallowing, knowledge of oral health, frequency of having a checkup in a dental clinic, and so on, have not been clearly elucidated.

To the best of our knowledge, only a few surveys of oral health conditions in PD patients have been reported, and only the small numbers of PD patients were surveyed in these studies.¹²⁻¹⁴ Persson et al.¹² compared only 30 PD patients with controls, while Nilsson et al.¹³ compared 75 PD patients with controls. However, they did not investigate the oral health conditions, but only the swallowing situation.

Patients with dyskinesia of the hands and/or face often suffer from poor oral hygiene. Patients with PD may be a high-risk group for caries and periodontal disease, and may have more complaints of poor oral health and more health problems in the oral cavity than the general population.

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The aim of the present study was to investigate oral health conditions and related factors that may influence oral health among patients with PD.

METHODS

Subjects

In Japan, patients with PD can receive public financial aid from the government if their disease stage according to Hoehn and Yahr is from III to V,¹⁵ and the eligible study cases were all of 240 patients with PD who received public financial aid in the Okhotsk area, in 2000. Okhotsk is located in the eastern part of Hokkaido, and is one of tertiary medical-care zones in Hokkaido. Among them, 201 PD patients participated in a meeting held in the city of Abashiri or were certified in the cities of Kitami and Monbetsu. They were asked to take part in this survey, and 109 patients responded (response rate, 54.2%). We used 104 patients aged over 60 years as cases. In 2001, 422 persons got dental check-ups in basic health examinations of cities and towns in Okhotsk. We selected 191 persons aged over 60 years as controls. Sex and age distribution of the 104 cases with PD and 191 controls are shown in Table 1.

Table 1. Sex and age distribution of 104 Parkinson's disease patients and 191 controls.

age (year)	Parkinson's disease			control		
	male	female	total	male	female	total
60-69	14	24	38	47	74	121
70-79	25	24	49	28	32	60
80+	5	12	17	3	7	10
total	44	60	104	78	113	191

Method of Survey

During the period spanning January through March in 2000, we investigated the patients with PD mostly by mail (196 patients), and in part, by interview (5 patients). A structured questionnaire was employed for both patients and controls. As shown in Appendix, common questions in the survey for patients and controls were about oral complains, the presence of their own teeth, tooth brushing, denture condition, and the presence of a family dentist. Question items for all cases and controls were bad breath, swollen gums, chewing difficulties, the presence of their own teeth, and the presence of a family dentist. Those for people with dentures were denture discomfort and denture condition. People having own teeth were asked about toothache, gingival bleeding, food impaction, tooth movement, and tooth brushing. In addition, disability in brushing, the condition of swallowing, having a checkup in a dental clinic, and knowledge of oral health were surveyed among PD patients. A dentist in the Kitami Public Health Center of Hokkaido (the first author) examined the teeth of the

422 controls, and they completed the self-administrated questionnaires by themselves. No interview survey or mailing survey was employed for the controls. The present study was approved by the Ethics Committee of Sapporo Medical University.

Analyses

We compared the case group with the control group using the unconditional logistic regression model¹⁷ adjusted for sex and age. The adjusted odds ratio (OR) and its 95% confidence interval (CI) were estimated. We also conducted stratified analysis by sex and age group using this model. The χ^2 test and the Cochran-Mantel-Haenzel test were used for simple and stratified analyses of knowledge of oral health among PD patients, respectively. Tests of statistical significance were based on two-sided P values, and the α -error was set at the 5% level. The SAS[®] system (ver. 8) was employed for the analysis.¹⁷

RESULTS

Results from a case-control study

Table 2 shows results using the unconditional logistic regression model, in men and women after adjusting for age, and in young elderly (from 60 to 69 years old) and old elderly (over 70 years old) after adjusting for age and sex.

As shown in Table 2, more PD patients complained of chewing difficulties (OR = 6.0, 95% CI:2.8-12.8) after adjustment for sex and age. After adjusting for age, more PD patients complained of them than controls among both men (OR = 14.5, 95% CI:3.0-69.1) and women (OR = 4.2, 95% CI:1.7-10.5). In addition, more PD patients complained of chewing difficulties (young: OR = 4.5, 95% CI:1.6-12.3; old: OR = 8.9, 95% CI:2.5-32.0) than controls in both young and old elderly.

Persons without their own teeth were more commonly seen among the PD patients than in the control group adjusted for sex and age (OR = 3.5, 95% CI:1.8-6.8). PD patients more commonly lacked their own teeth than controls in both sexes after adjusting for age (men: OR = 3.6, 95% CI:1.0-12.0; women: OR = 3.5, 95% CI:1.6-7.7). Among the old elderly, those without their own teeth were more commonly seen among PD patients than controls after adjusting for age and sex (OR = 4.1, 95% CI:1.8-9.3).

Among the young elderly, more PD patients complained of swollen gums than controls after adjusting for age and sex.

There were no differences between the two groups about having their own family dentists. Of the PD patients, 71 (68%) had their own family dentists.

More PD patients complained of denture discomfort (OR = 3.9, 95% CI:1.9-8.0) than controls after adjustment for sex and age. Although the proportion of those who complained of denture discomfort did not differ between the two groups for men, more female PD patients complained of denture discomfort than female controls. More PD patients complained of denture discomfort (young: OR = 2.9, 95% CI:1.0-8.5; old: OR = 5.0, 95% CI:1.8-13.9) than controls in both the young and old elderly.

Table 2. Results of logistic regression analysis using 104 Parkinson's disease patients and 191 controls.

	total		adjusted for sex, age						by sex adjusted for age						by age strata adjusted for sex, age					
			male			female			from 60 to 69 years old			over 70 years old								
			cases n (%)	controls n (%)	odds ratio (95% CI)	cases n (%)	controls n (%)	odds ratio (95% CI)	cases n (%)	controls n (%)	odds ratio (95% CI)	cases n (%)	controls n (%)	odds ratio (95% CI)						
	cases	controls	odds ratio	cases	controls	odds ratio	cases	controls	odds ratio	cases	controls	odds ratio	cases	controls	odds ratio					
	n (%)	n (%)	(95% CI)	n (%)	n (%)	(95% CI)	n (%)	n (%)	(95% CI)	n (%)	n (%)	(95% CI)	n (%)	n (%)	(95% CI)					
	population																			
Oral complaints																				
① Toothache	60	169	1.7 (0.7-4.3)	9 (15)	16 (9)	1.7 (0.7-4.3)	5 (17)	7 (10)	2.0 (0.6-7.2)	4 (13)	9 (9)	1.4 (0.4-5.4)	3 (10)	12 (11)	1.0 (0.3-4.1)	6 (19)	4 (7)	3.9 (0.9-17.6)		
② Gingival bleeding	60	169	1.1 (0.5-2.8)	8 (13)	21 (12)	1.1 (0.5-2.8)	4 (14)	9 (12)	1.1 (0.3-3.8)	4 (13)	12 (13)	1.2 (0.4-4.3)	5 (17)	16 (14)	1.2 (0.4-3.6)	3 (10)	5 (9)	0.9 (0.2-4.2)		
③ Food impaction	60	169	2.1 (1.1-3.9)	36 (60)	71 (42)	2.1 (1.1-3.9)	18 (62)	31 (42)	1.8 (0.8-4.5)	18 (58)	40 (42)	2.4 (0.9-5.6)	19 (66)	48 (42)	3.0 (1.2-7.1)	17 (55)	23 (42)	1.5 (0.6-3.8)		
④ Bad breath	104	191	1.4 (0.7-2.9)	16 (15)	23 (12)	1.4 (0.7-2.9)	8 (18)	11 (14)	1.6 (0.6-4.3)	8 (13)	12 (11)	1.4 (0.6-3.5)	8 (21)	15 (12)	1.8 (0.7-4.7)	8 (12)	8 (11)	0.9 (0.3-2.9)		
⑤ Tooth movement	60	169	2.0 (0.7-6.3)	6 (10)	8 (5)	2.0 (0.7-6.3)	4 (14)	4 (5)	2.5 (0.6-11.1)	2 (6)	4 (4)	1.5 (0.3-9.1)	3 (10)	3 (3)	4.7 (0.8-26.5)	3 (10)	5 (10)	1.1 (0.2-5.1)		
⑥ Swollen gums	104	191	1.8 (0.9-3.9)	17 (16)	18 (9)	1.8 (0.9-3.9)	6 (14)	7 (9)	1.4 (0.4-4.7)	11 (18)	11 (10)	2.2 (0.9-5.7)	8 (21)	9 (7)	3.4 (1.2-10.1)	9 (14)	9 (13)	1.1 (0.4-2.9)		
⑦ Chewing difficulties	104	191	6.0 (2.8-12.8)	29 (28)	12 (6)	6.0 (2.8-12.8)	13 (32)	2 (3)	14.5 (3.0-69.1)	16 (27)	10 (9)	4.2 (1.7-10.5)	11 (29)	9 (7)	4.5 (1.6-12.3)	18 (27)	3 (4)	8.9 (2.5-32.0)		
⑧ Denture discomfort	80	104	3.9 (1.9-8.0)	32 (40)	17 (16)	3.9 (1.9-8.0)	7 (23)	7 (17)	1.7 (0.5-5.6)	25 (51)	10 (16)	6.4 (2.5-16.5)	10 (36)	11 (21)	2.9 (1.0-8.5)	22 (42)	6 (12)	5.0 (1.8-13.9)		
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No own teeth	104	191	3.5 (1.8-6.8)	38 (37)	22 (12)	3.5 (1.8-6.8)	10 (25)	5 (6)	3.6 (1.0-12.0)	28 (48)	17 (15)	3.5 (1.6-7.7)	6 (17)	7 (6)	3.1 (0.9-10.3)	32 (51)	15 (21)	4.1 (1.8-9.3)		
Do not brush teeth every day	60	169	P < 0.01*	17 (28)	0 (0)	P < 0.01*	7 (24)	0 (0)	P < 0.01*	10 (32)	0 (0)	P < 0.01*	5 (18)	0 (0)	P < 0.01*	12 (38)	0 (0)	P < 0.01*		
Do not clean dentures every day	80	104	10.5 (2.9-37.7)	19 (24)	3 (3)	10.5 (2.9-37.7)	8 (29)	2 (5)	7.8 (1.4-42.7)	11 (25)	1 (2)	19.4 (2.3-162.9)	5 (21)	1 (2)	13.2 (1.4-121.6)	14 (30)	2 (4)	9.7 (2.0-46.7)		
Do not remove dentures and put them in a cup of water	80	104	1.8 (1.0-3.5)	33 (41)	35 (34)	1.8 (1.0-3.5)	15 (48)	12 (29)	2.4 (0.9-6.4)	18 (38)	23 (37)	1.6 (0.7-3.8)	17 (63)	31 (58)	2.4 (0.9-6.4)	16 (31)	13 (25)	1.4 (0.6-3.5)		
Do not have own family dentist	104	191	0.8 (0.4-1.4)	24 (23)	54 (28)	0.8 (0.4-1.4)	7 (18)	23 (29)	0.6 (0.2-1.5)	17 (30)	31 (27)	0.9 (0.4-2.0)	7 (21)	33 (100)	0.7 (0.3-1.8)	17 (28)	21 (30)	0.8 (0.4-1.8)		

CI: confidence interval

—: not calculated

*: Fisher's exact test

Table 3. Conditions of oral health among 104 Parkinson's disease patients.

○ Disability in brushing their teeth or cleaning their dentures	
Number having trouble	51 (49%)
Number having no trouble	45 (43%)
Number of nonresponders	8 (8%)
Total	104 (100%)
○ gargling	
Number able to gargle	63 (60%)
Number only able to put a single swallow of water in their mouth	30 (29%)
Number not able to gargle at all	8 (8%)
Number of nonresponders	3 (3%)
Total	104 (100%)
○ Swallowing	
Number with no problem	41 (39%)
Number always choking during eating or drinking	12 (12%)
Number choking only when they drank a cup of water	5 (5%)
Number sometimes choking	39 (37%)
Number of nonresponders	7 (7%)
Total	104 (100%)
○ Brushing	
Number able to brush their teeth by themselves	39 (65%)
Number able to brush their teeth with assistance	5 (8%)
Number not able to brush their teeth by themselves	8 (13%)
Number of nonresponders	8 (13%)
Total (having their own teeth)	60 (100%)
○ Denture wearing	
Number removing and putting their dentures in by themselves	66 (82%)
Number either removing or putting their dentures in by themselves	3 (4%)
Number neither removing nor putting their dentures in by themselves	7 (9%)
Number of nonresponders	4 (5%)
Total(having own dentures)	80 (100%)
○ Access to a dental clinic	
Number able to go to a dental clinic alone	31 (30%)
Number able to go to a dental clinic if there was assistance by family members	30 (29%)
Number able to go to a dental clinic if there was assistance by helpers	5 (5%)
Number not able to go to a dental clinic without transportation service by car	15 (14%)
Number not able to go to a dental clinic in any case	10 (10%)
Number of nonresponders	13 (12%)
Total	104 (100%)
○ Content of home-visiting dental service	
Number looking forward to have a dental check-up and tooth brushing instruction	28 (27%)
Number not needing them at that time but wanted to use a home-visiting dental service in the future	34 (33%)
Number not looking forward to home-visiting dental service	25 (24%)
Number of nonresponders	17 (16%)
Total	104 (100%)

Fewer PD patients cleaned their dentures every day than in the control group after adjustment for sex and age (OR = 10.5, 95% CI:2.9-37.3). Fewer PD patients cleaned their own dentures every day than controls in both sexes. Fewer PD patients cleaned their dentures every day than controls in both the young and old elderly after adjusting for age and sex.

There were no differences between the PD patients and the control group about storing their own dentures correctly before sleeping. Forty-five PD patients (56%) removed their own dentures and put them in a cup of water before sleeping.

More PD patients complained of food impaction than controls after adjustment for sex and age. Among the young elderly, more PD patients complained of food impaction than controls after adjusting for age.

Fewer PD patients brushed their teeth every day than in the control group ($p < 0.01$), in both sexes ($p < 0.01$), and in both the young and old elderly ($p < 0.01$).

Knowledge and condition of oral health among PD patients

Few PD patients had knowledge of dental floss (3%), brushes for cleaning dentures (19%) and coating of the tongue (14%).

Table 3 shows oral-health conditions among 104 PD patients. Fifty-one PD patients (49%) had trouble brushing their teeth or cleaning their dentures, 38 patients (37%) had difficulty gargling. As for swallowing, 56 PD patients (54%) answered that they had some problems. Among the 60 patients who had their own teeth, 21 (35%) had trouble brushing by themselves. Among 80 PD patients who had dentures, 10 (13%) had some problems about either removing or putting them in by themselves. Concerning regular checkups of their dentures, 24 PD patients (30%) had never gone to a dental clinic after they had been made. Seven patients (7%) had been refused treatment in a dental clinic due to their disease. Fifty patients (48%) answered that they were able to go to a dental clinic if there was assistance by either family members or helpers, and transportation service by car, and 10 (10%) could not go to a dental clinic in any case. Of these 10 patients, 9 (90%) wanted to use home-visiting dental services. As for the content of home-visiting dental service, 62 patients (60%) wanted to have a dental check-up and tooth brushing instruction either at present or in the future.

DISCUSSION

As far as we know, this is the first study of oral health conditions in PD patients compared with controls in Japan. Although Fukayo¹⁴ reported about oral health conditions of PD patients, they did not compare them with controls.

The oral health conditions of 104 PD patients

In the present study, those who complained of chewing difficulties were more common among PD patients than controls after adjustment for sex and age. This indicated that chewing difficulties might be common in PD patients. This may be explained by

the following reasons. First, PD patients may suffering from dyskinesia such as flycatcher tongue and lip.¹⁸ Second, PD patients may be suffering from mastication disorders with oral dyskinesia^{7,19} or xerostomia²⁰ caused by the administration of anticholinergics and so on. In contrast, Persson et al.¹² failed to show a significant difference in the rate of those with chewing difficulties between PD patients and a control population sample because of the small sample size (10 of 30 PD patients [33%] complained of chewing difficulties, as did 20 of 526 controls [4%]).

The present study revealed that more PD patients complained of denture discomfort, in particular female patients. This result was consistent with the report by Kieser et al.²¹ suggesting that a third of PD patients have loose dentures or poor denture control. This may be explained by the following reasons. First, PD patients may be suffering from oral dyskinesia^{7,19} or xerostomia²⁰ caused by the use of anticholinergics. Second, PD patients may be suffering from lack of muscle coordination and rigid facial muscles that jeopardize denture retention and control²⁰. Many female, but not so many male, PD patients complained of denture discomfort. It is possible that, compared with male PD patients, female PD patients might suffer from denture discomfort caused by involuntary movements of some facial muscles, the tongue and lips, as oral dyskinesia is more commonly seen in elderly woman than in elderly men⁴⁷.

The present study showed that many PD patients did not have their own teeth, regardless of sex. This result was the opposite of the results of studies reported in Europe showing that caries were generally less common in PD patients than in controls, and that teeth were retained longer in PD patients than in controls.^{12,18} This may be explained by the following possibilities. Many PD patients in the present survey had lost their teeth due to many years of poor oral hygiene because fewer PD patients brushed their teeth every day or they had difficulty going to a dental clinic in the early stage of caries. The results of the present study may suggest that the support for oral health for PD patients in Japan remains less sufficient than in Europe.

Because PD patients often suffer from heartburn and nausea, causing a decrease in oral hygiene^{6,21} as well as xerostomia, leading to an increased risk of caries due to the use of anticholinergics or monoamine oxidase inhibitors,^{18,21} PD patients may have a high risk of losing their teeth.

Swallowing among PD patients

Fifty-six of the 104 (54%) PD patients had some subjective problems swallowing. In western countries^{6, 20, 22} about half of PD patients are reported to have dysphagia. However, we may have underestimated the proportion of the PD patients with dysphagia in the present study because of the following reasons. First, several studies have revealed that PD patients have swallowing difficulties without any subjective symptoms.^{5,11,13,23} Second, Nilsson et al.¹³ found dysphagia in more than 90% of PD patients who were in the same stages as our study subjects (Hoehn and Yahr stages III and IV). Most of the PD patients in the present survey

may have had poor oral hygiene, because only a few of them brushed their teeth every day. Therefore, they might be susceptible to aspiration pneumonia via aspiration of saburra and indigenous oral bacterial flora.^{5,6,11,23} In addition, most elderly PD patients may have a high risk of severe aspiration pneumonia because elderly people are more likely to contract oral candidiasis^{7,8} and fatal moniliasis pneumonia⁹ when they have poor oral hygiene and denture discomfort.

Bucbboz²⁴ reported that the most common cause of death among progressive PD patients was aspiration pneumonia.

Oral health behavior of PD patients

We found that very few PD patients brushed their teeth every day or cleaned their dentures every day. They probably had difficulties because of their PD symptoms such as resting tremors, akinesia and bradykinesia.^{20-22,25,26}

Even though most PD patients complained of food impaction, few PD patients had knowledge about the interdental brush. Therefore, it is very important for PD patients to get appropriate dental health advice from a dentist or dental hygienist, especially from their own family dentists. This is consistent with the report by Kieser et al.²¹ who recommended that patients with neurodegenerative disorders should be followed by the same dentist.

However, most PD patients wanted to have dental treatment and dental health services by home visits because it was very difficult for them to receive those services at dental clinics unless their families took them there. Fiske et al.²⁰ reported that domiciliary dental care was important for PD patients because one of the major barriers to receive dental care was access to dental premises.

The results of the present study may show that many kinds of support (e.g., environmental considerations and advice on oral care for families of PD patients and their caregivers, usual support of oral care at the home by a welfare agency such as a home nursing station, special transport service to go to the dental clinic, and an increase of dental clinics doing dental treatment by home visits) are necessary for PD patients to maintain good oral health conditions, to prevent aspiration pneumonia and to have good quality of life.

There are some limitations to our study. First, information on most PD patients was obtained by mail; only 5 PD patients were interviewed. Because information of mailed self-administered questionnaire may be inferior to one by personal interview in quality, there is a possibility of information bias to some extent in our study. Second, we did not check the duration of the disorder. There is a possibility of survival bias, because we used not only incident cases but also prevalent cases. Third, the controls were not randomly selected from the general population, but were recruited from persons at health checkups. The tooth characteristics of 191 controls compared with participants of a survey on dental diseases in 1999¹⁶ are shown in Table 4. Averages of tooth characteristics in the control group were calculated by adjusting

Table 4. Tooth characteristics of 191 controls compared with general population.¹⁶

	average number of		average number of untreated teeth	average number of missing teeth	average number of DMFT*	proportion of people with edentulous jaw (%)
	intact teeth	treated teeth				
	Male					
Control group adjusted for age [†]	9.1	8.8	0.8	9.4	18.9	6.4
General population (over 60 years old)	7.3	7.7	1.4	12.1	21.2	14.3
	Female					
Control group adjusted for age [†]	4.7	10.9	0.3	12.1	23.3	15.0
General population (over 60 years old)	5.3	8.0	1.0	13.9	22.9	17.1

*: Average number of decayed teeth, missing teeth or filled teeth per person.

†: Averages of tooth characteristics in the control group were calculated by adjusting age via a direct method using the data of the survey on dental diseases in 1999¹⁶ as a standard population.

age with a direct method using the data of the survey on dental diseases in 1999¹⁶ as a standard population. As shown in Table 4, more controls had their own teeth than in the general population among males. We must consider the effect of using healthy participants as controls.

In conclusion, we found that PD patients had more complaints about their oral health (e.g., chewing difficulties, denture discomfort) and more problems in the oral health behavior than the general population. In addition, more than half of PD patients had problems with swallowing. These findings may be useful for the caregivers of PD patients to conduct oral care as well as for making health plans for dental care for PD patients and for medical and welfare services. Furthermore, dental staff members in public health centers should strengthen training for caregivers to enhance knowledge and skills about oral care, as well as dental checkups and dental health services by home visits for PD patients.

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Appendix. Questionnaire for the survey.

What are your oral complaints ? Please check all which apply.

- | | | |
|---|---|---|
| <input type="checkbox"/> ① Toothache | <input type="checkbox"/> ② Gingival bleeding | <input type="checkbox"/> ③ Food impaction |
| <input type="checkbox"/> ④ Bad breath | <input type="checkbox"/> ⑤ Tooth movement | <input type="checkbox"/> ⑥ Swollen gum |
| <input type="checkbox"/> ⑦ Chewing difficulties | <input type="checkbox"/> ⑧ Denture discomfort | |
-

Do you have your own teeth (including capped teeth) ?

- ① yes ② no
-

Do you brush your teeth every day?

- ① yes ② sometimes or never
-

Do you clean your dentures every day?

- ① yes ② sometimes or never
-

Where do you keep your dentures while sleeping?

- ① remove dentures and put them in the cup of water
 ② remove dentures and leave them in air, or keep them in your mouth
-

Do you have your own family dentist?

- ① yes ② no
-

before or at the time of surgery.⁴ However, presurgical cultures might not reliably predict endophthalmitis complicating corneal transplantation.¹⁰ For the two cases described in this report, culture results were not available early enough in the infection to prevent disease in recipients. If a corneal culture obtained at surgery identifies a pathogen, clinicians should evaluate the patient's condition promptly and consider initiation of appropriate therapy.

Metastatic colon cancer alone is not a factor that prompts deferral of a donor; however, the medical director should evaluate information about any potential donor with metastatic colon cancer to determine whether the donation should proceed. The risk for clostridial disease from corneas should be a consideration for tissue bank directors when evaluating potential donors with metastatic colon cancer. EBAA recommends that surgeons report adverse events, including cases of *C. perfringens* endophthalmitis, to eye banks and subsequently to EBAA within 30 days of the occurrence for review by a medical advisory board.⁴ State health departments, CDC, and FDA should be notified to assist with investigations.

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Update: Creutzfeldt-Jakob Disease Associated With Cadaveric Dura Mater Grafts— Japan, 1979-2003

MMWR. 2003;52:1179-1181

2 figures omitted

In 1997, A NONGOVERNMENT SURVEILLANCE group for Creutzfeldt-Jakob disease (CJD) in Japan supported financially by the Ministry of Health and Welfare* (MHW) reported 43 cases of CJD associated with receipt of cadaveric dura mater grafts.¹ In all but one case, the most probable vehicle of transmission was a single brand of dural graft (LYODURA® [B. Braun Melsungen AG, Melsungen, Germany]) produced before May 1987. As of March 2003, ongoing surveillance in Japan had identified an additional 54 dura mater graft-associated cases. This report summarizes the investigation of the 97 cases, which indicated that during 1983-1987, the estimated minimum risk for CJD within 17 years of receipt of the implicated product in Japan was approximately one case per 1,250 grafts. No cases have been reported among patients who received their first dural graft after 1991; however, because of the long latency period between graft placement and symptom onset, additional cases of graft-associated CJD are likely to be reported.

During 1996-2003, cases of CJD were identified in Japan by using (1) a mail survey of neurologic, psychiatric, and neuropathologic institutions (overall response rate: 74%)¹ and (2) subsequent reporting of CJD patients by clinicians

to MHW. During this period, 97 cadaveric dura mater graft-associated CJD cases were identified. A case of dura mater-associated CJD was defined as a case in which a patient received a cadaveric dura mater graft and subsequently had CJD diagnosed by a physician and reviewed and accepted as CJD by a surveillance panel of neurologists.

The 97 CJD patients had illness onset during September 1985-April 2002 (Figure 1). Median age at onset was 58 years (range: 15-80 years); mean age was 55 years. Mean age at onset was younger than that reported for sporadic CJD in Japan (66 years). A total of 58 (60%) patients were female. Neuropathologic confirmation of CJD diagnosis was obtained for 20 (21%) patients; 65 (84%) of the other 77 patients with physician-diagnosed CJD had an electroencephalogram with a periodic synchronous discharge pattern consistent with CJD.

All 97 patients received dura mater grafts during 1978-1991 (Figure 2). Three patients received more than one dural graft during this period, including one patient reported previously.¹ In all three cases, the first graft was considered to be the source of infection. Medical conditions leading to the use of dural grafts in these patients included tumor (n=46), brain hemorrhage (n=14), Jannetta procedure for facial palsy (n=13) and for trigeminal neuralgia (n=six), intracranial aneurysm (n=eight), unspecified anomalies (n=five), hematoma (n=three), injury (n=one), and ossification of the spinal posterior longitudinal ligament (n=one).

Latency periods ranged from 14 months (receipt in 1987 and onset in 1989) to 275 months (receipt in 1978 and onset in 2001). The median and mean latency periods were 122 and 125 months, respectively. A total of 93 patients received dural grafts during 1978-1987. In 1987, the manufacturer revised collection and processing procedures for the implicated product to reduce the risk for CJD transmission. Four patients received grafts during 1988-1991. No cases have been reported among patients who received their first dural graft after 1991. A total

of 86 (89%) patients were documented to have received LYODURA®; the brand name of dural graft was unknown for 11 patients. A total of 81 (84%) of the 97 patients received their dural grafts during 1983-1987, during which time an estimated 100,000 patients received LYODURA® grafts in Japan. All 81 patients died from CJD within 17 years after receipt of the grafts. Lot numbers of the dura mater grafts used for the 97 patients could not be identified. As of September 2003, five additional cases were under investigation in Japan for suspected dural graft-associated CJD.

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CDC Editorial Note: Dural graft-associated CJD cases continue to be identified in Japan. The estimated minimum risk within 17 years after receipt of LYODURA® is approximately one case per 1,250 recipients. The precise number of dura mater grafts used in Japan is unknown, but an estimated 20,000 grafts per year might have been used during 1983-1987. The widespread use of LYODURA® during neurosurgical procedures in Japan is the most probable source of the unusually high number of dural graft-associated CJD cases in Japan.² Dural graft recipients have symptom onset at a younger age compared with age at onset in sporadic cases of CJD in Japan. The identification of additional cases over time has resulted in an expected increase in the latency period between dural graft placement and symptom onset. The mean and range for this latency of CJD from contaminated grafts is unknown, but the upper limit now exceeds 22 years. The occurrence of new cases, the increase in the mean and

range of the latency period, and the identification of suspected cases under investigation all suggest that this outbreak is ongoing.

No cases in Japan were reported to be related to receipt of a dural graft other than LYODURA®. For 11 cases, the manufacturer brand name was unknown. Although LYODURA®, or in one case either LYODURA® or a dural graft from another manufacturer (Tutoplast® [Pfrimmer-Viggo GmbH & Co., Erlangen, Germany]), was suspected in these cases, documentation of a specific source was unavailable. Four patients received dural grafts after collection and processing procedures were revised by the manufacturer in 1987, but whether the implicated dural grafts were LYODURA® produced before 1987 is unknown. That all LYODURA®-associated CJD cases to date occurred among patients who received grafts before 1992 suggests that all implicated grafts likely were processed before 1987; the implicated product's expiration date is 5 years after processing.

LYODURA® never was produced by the manufacturer for distribution in the United States, and relatively few LYODURA® grafts were used in this country. In May 1987, after identification of the first dural graft-associated CJD case in a U.S. patient who had received the implicated product, the manufacturer revised its procedures for collecting and processing dura mater grafts to reduce the risk for CJD transmission (e.g., by discontinuing the commingling of dura and disinfecting them with sodium hydroxide).^{3,4} Subsequently, numerous other dura mater graft-associated cases were identified worldwide; nearly all patients had received the implicated product, including one additional U.S. patient. In 1997, the report of 43 cases of dura mater graft-associated CJD in Japan represented the largest cluster of such cases in any one country.¹

In one of the CJD cases reported in Japan, the implicated graft was used in a spinal (not an intracranial) procedure. This case suggests that transmission from contaminated dura might oc-

cur in areas of the neuraxis outside of the cranial vault.

In 1997, the Food and Drug Administration's Transmissible Spongiform Encephalopathy Advisory Committee (TSEAC) recognized that the use of human dura mater in the United States carries an inherent risk for transmitting CJD. However, the committee recommended that the use of such grafts be left to the discretion of the treating neurosurgeon, provided that the human dura mater is procured and processed according to appropriate safety measures.⁵ In 1997, an estimated 4,500 dural grafts were distributed for use in the United States.⁶ After the TSEAC recommendations were issued, the number of dural grafts distributed for use in the United States declined to an estimated 900 grafts in 2002 (B.E. Buck, M.D., Miami Tissue Bank, personal communication, 2003).

The cases described in this report indicate that recipients of contaminated dura mater grafts might remain at risk for CJD for >22 years after receiving grafts. CDC continues to conduct surveillance for cases of CJD in the United States. Patients with a rapidly progressive dementia consistent with CJD and a history of dural graft implantation should be reported through local or state health departments to CDC, telephone 404-639-3091.

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*Subsequently named the Ministry of Health, Labor, and Welfare.



Gender differences in the relationship between social support and subjective health among elderly persons in Japan

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Abstract

Objective. To examine the relationship of social support with subjective health by gender, and gender differences in the pathway from social support to subjective health.

Method. The subjects of this study were 754 noninstitutionalized elderly men and women aged 65 years and older living in a community in Japan. The data were collected by face-to-face interviews. The relationship between social support and subjective health was studied using multiple regression analyses stratified by gender.

Results. Mean social support score was significantly higher in women (4.3 ± 1.6) than in men (3.8 ± 1.8). Among elderly men, significant positive association between the level of social support and good subjective health was observed, but not among elderly women. The odds ratio for having good subjective health was 2.45 (95% confidence interval 1.02–6.43) for men who had a high level of social support compared with low level of social support. The direct effect of social support on subjective health was much larger in men (82.6%) than in women (23%).

Conclusion. These findings suggest that social support may be a beneficial promoter of subjective health in men than in women. The relationship between changes in the amount of social support and subsequently subjective health should be explored further.

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Keywords: Aged; Social support; Health status; Cross-sectional study

Introduction

Many studies have demonstrated that social support has a positive influence on health status in the elderly [1–9]. Uchino et al. [10] also found that social support was related to positive effects on the cardiovascular, endocrine, and immune systems. Kang and Bloom [11] also demonstrated that social support could be associated with increased use of mammography and occult blood stool examinations among older Black Americans. According to Shye et al. [12], men gain protection at a lower level of social support network size than women do. Ho [13] suggests that patterns of social network support may vary more consistently according to sex than by any other aspect of social status studied to date. Moreover, women tend to experience more chronic illness and functional impairments [14–16], suggesting the gender differences in the impact of those potential cofounders.

These findings indicate that the relationship between social support and subjective health should be addressed separately in men and women. However, few studies have examined the gender differences in the relationship between social support and health status in the elderly, although gender has been used merely as control variables in research.

In the present study, the association between social support and health status stratified by sex was examined in 754 elderly men and women in Japan.

Methods

Study sample

Subjects were 825 noninstitutionalized people aged 65 years and older (representing a 90% response rate) who agreed to in-home face-to-face interviews living in a rural town adjoining Nagoya City in Aichi prefecture, Japan. The interviews were conducted by six well-trained district welfare commissioners during January 2002 and March 2002.

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The study protocol was approved by the ethics committee in the town and written consent was obtained from all participants. Of those consented to participate ($N = 784$), 754 individuals (365 men and 389 women) with no missing data on any of the study variables were analyzed in the present study.

Measurements

Social support, in particular emotional, was assessed with the following two aspects: (a) the willingness of spouse, children, and others to listen to the personal problems and inner feeling of the respondent; and (b) the amount of love and caring the respondent can expect from spouse, children, and others [17]. For the above two questions, we asked each respondent to rate the level for each of the three types of significant others (i.e., spouse, children, and others relatives and friends) with 5-point scales (ranging from 0 “never” to 4 “a great deal of”). The strongest level of support rated among the three types was regarded as the amount of support for each aspect. Similar to other studies, we are also concerned with the amount, rather than the source of social support, an older person can expect. We built a composite score, that is, social support score, from two sources of social support. Because not all respondents have all three sources, each respondent has a possible range from 0 to 8 on these variables. According to the tertiles of distribution of social support score stratified by sex, subjects were classified into three groups; low (0–3), moderate (4–5), and high (6–8).

Health status was considered by a measure of subjective health, which was assessed on the basis of response to the statement “How do you evaluate your present health condition” (1 = “excellent”, 2 = “good”, 3 = “average”, 4 = “rather poor”, 5 = “poor”). In this study, subjects who responded “excellent” or “good” were considered to be in good health, and those who responded “average”, “rather poor”, or “poor” were considered to be in suboptimal health.

The following covariates were selected on the basis of available evidence suggesting their possible association with social support, subjective health, or both: age, living arrangement, medical treatment, somatic symptoms, depression, and loneliness. Living arrangement was categorized into three groups according to resident status: living alone, living with a spouse, and living with others other than a spouse. Medical treatment was assessed with the presence or absence of the following chronic medical conditions during the past 12 months: hypertension, diabetes mellitus, angina, myocardial infarction, stroke, bronchitis, asthma, hepatitis B or liver disease, anemia, circulatory troubles in extremities, hip fracture, or arthritis. These conditions were considered “present” if subjects reported that they had ever been diagnosed by a doctor or if they had been hospitalized for conditions. The number of medical conditions was classified as 0 (none), and 1 or more (any).

Somatic symptoms experienced during the previous month were assessed by ascertaining the frequency of 10 symptoms: headache, heart palpitations or irregular heart beat, difficulties in breathing or shortness of breath without physical effort, dizziness, stomachache, nausea or vomiting, heart burn, diarrhea, constipation, and problems in passing urine. The number of symptoms was classified as 0 (none) and 1 or more (any).

Depressive symptoms, which were chosen to be representative of mental health condition, was measured with the Center for Epidemiologic Studies depression scale (CES-D), which is a widely used survey measure of depressive symptomatology [17]. This scale consists of 20 items that ask how often specific symptoms were experienced during the past week. Two measures were derived from the CES-D score, a continuous measure based on the overall score and dichotomous measure of high levels of depressive symptomatology, or depressive, defined as a score of 18 or greater.

Loneliness is the unpleasant experience that occurs when a person’s network of social relationship is perceived to be deficient, either quantitatively or qualitatively. Loneliness was ascertained by binary responses (yes, no).

Statistical analysis

First, the differences of means were tested with analysis of variance and of the distribution of proportions with the

Table 1
Sociodemographic characteristics of respondents

Variables	Total ($n = 754$)	Men ($n = 365$)	Women ($n = 389$)	p values (men vs. women)
Age group (years)				
65–74	66.1	69.3	62.9	
75–89	33.9	30.7	37.1	0.16
Mean \pm SD	72.6 (6.0)*	72.2 (6.0)	72.9 (6.0)	0.13
Means social support score	4.1 \pm 1.6	3.8 \pm 1.8	4.3 \pm 1.6	<0.001
Subjective health (%)				
Good	75.1	75.9	76.1	
Suboptimal	24.9	24.1	23.9	0.14
Living arrangement (%)				
Living alone	4.5	2.2	6.8	
Living with spouse	18.6	24.1	13.3	
Living with others	76.9	73.7	79.9	0.67
Medical treatment (%)				
None	30.4	32.8	28.2	
Any	69.6	67.2	71.8	0.16
Somatic symptoms (%)				
None	45.4	50.7	40.1	
Any	54.6	49.3	59.9	0.04
CES-D (%)				
Not depressed (<18)	89.4	87.9	90.8	
Depressed (\geq 18)	10.6	12.1	9.2	0.20
Loneliness				
No	75.0	77.8	72.3	
Yes	25.0	22.2	27.7	0.02

* Mean (standard deviation).

Table 2
Comparison of selected characteristics according to the level of subjective health in 745 persons

Variables	Men			Women		
	Subjective health		<i>p</i> value ^a	Subjective health		<i>p</i> value ^a
	Suboptimal	Good		Suboptimal	Good	
Mean age (years)	72.6 (6.2) [§]	72.0 (6.1) [§]	0.12	73.6 (5.8) [§]	72.6 (6.1) [§]	0.12
Social support (%)						
Low	46.1	28.6		32.0	16.3	
Moderate	29.2	32.2		22.0	33.3	
High	24.7	39.2	0.005	46.0	50.3	0.03
Living arrangement (%)						
Living alone	3.4	1.8		7.4	6.6	
Living with spouse	22.7	24.6		13.7	13.1	
Living with others	73.9	73.7	0.63	78.9	80.3	0.95
Medical treatment (any) (%)	57.5	42.5	0.000	37.1	62.9	0.000
Somatic symptoms (any) (%)	26.2	13.1	0.01	27.1	17.3	0.06
Depressive symptomatology (depressed) (%)	29.3	6.8	0.000	22.4	5.1	0.000
Loneliness (yes) (%)	34.1	18.4	0.002	39.8	23.6	0.002

[§] Mean (standard deviation).

^a Based on chi-square test for qualitative and analysis of variance for continuous variables.

chi-square test according to the level of subjective health by genders. Second, a multivariate logistic regression model was used to assess the relationship between social support with subjective health. The results of logistic regression analyses are presented as odds ratios (OR). In addition, 95% confidence intervals are calculated for the OR. All analyses were conducted using SPSS ver10.0 for Macintosh (Statistical Package for the Social Science, SPSS Inc. Chicago, IL).

Results

The distribution of respondents' characteristics by gender is shown in Table 1. No significant differences in mean age and the proportion of subjects rating good subjective health were observed between men and women. Mean social support scores were significantly higher in women than in men. The proportion of subjects with any somatic symptoms was significantly higher in women than in men. The proportion of subjects reporting loneliness was significant in men and in women. Living arrangement and the propor-

tion of subjects with depressive symptomatology were the same in men and women.

Table 2 shows selected characteristics by level of social support between men and women. Depressive symptomatology and loneliness significantly decreased with increasing social support score in both men and women. The proportion of subjects with good subjective health was significantly associated with social support score in men but not in women.

Table 3 presents results of logistic regression analyses controlling for age, living arrangement, medical treatment, somatic symptoms, depressive symptomatology, and loneliness. Low level of social support was the reference category. In women, social support score was not associated with good subjective health. In men, analyses showed a dose-response association between good subjective health and the level of social support. In comparison with low level of social support, the odds for good subjective health were multiplied by 1.39 and 2.45 for men who had moderate and high level of social support, respectively.

Table 4 presents the decomposition of the total effect of social support on subjective health. The direct effect is composed of the direct effect and the indirect effect; the direct effect means the magnitude of direct relationship between subjective health and the social support, and the indirect effect means that of indirect relationship through

Table 3
Adjusted odds ratio for good health according to the level of social support in 745 persons

Variables	Men		Women	
	OR ^b	95% CI ^b	OR ^b	95% CI ^b
Social support				
Low	1.00		1.00	
Moderate	1.39	1.02–4.17	1.11	0.25–1.98
High	2.45	1.25–6.43	1.22	0.68–3.23
<i>p</i> for trend	<i>p</i> = 0.03		<i>p</i> = 0.51	

^a Adjusted for age, living arrangement, medical treatment, somatic symptoms, depressive symptomatology, loneliness.

^b OR, odds ratio; CI, confidence interval.

Table 4
Decomposition of total effect of social support on subjective health into direct and indirect effects by gender

Type of effect	Men		Women	
	Magnitudes of effect	Percent of effect (%)	Magnitudes of effect	Percent of effect (%)
Total effect	0.23	100.0	0.10	
Direct effect	0.19	82.6	0.023	23.0
Indirect effect	0.04	17.4	0.077	77.0

other variables. The indirect effect of social support is estimated by the differences between the total and direct effects [18]. Of the total effect of social support on subjective health, the direct effect of social support was much greater in men (82.6%) than in women (23.0%).

Discussion

In this cross-sectional study, the results indicate that the relationship between social support and subjective health is sex-dependent among elderly persons in Japan. Women had significantly higher social support score than men. A significant positive linear association between the level of social support and good subjective health was found for men, but not such relation for women, even after other confounding factors.

The rationale of conducting analyses by sex is that, in this study, the significant difference in social support score was observed between men and women as in previous studies [19–21]. Women have larger and more multifaceted networks than men, and provided and receive more support from members of their network than men [21]. Women's friendships focus on intimacy and disclosure, while that of the men emphasize sociability [22] and task or activity orientation [23,24]. These differences concern not only health status but also the factors associated with it. In this study, we found associations among depression, loneliness, somatic symptoms, and social support. However, to our knowledge, few studies have reported results of separate analysis stratified by sex. Accordingly, this is the first study that sex differences in the relationship between social support and subjective health have been demonstrated among elderly persons, although this was a cross-sectional study.

In this study, we only used self-reported emotional support as being one aspect of social support. This is because emotional support is reported to play a more beneficial role for better physical functioning and reduced mortality risks than instrumental support [25]. In addition, it is not known whether bias due to overestimation of self-reported social support was similar in nature and magnitude in both sexes. Women tend to be more prone to social desirable answer than in men [26,27]. Therefore, we used interviewers who have no personal acquaintance with elderly subjects to avoid the effects of information bias such as social desirability. The possibility of the sex-dependent bias and measurement error that cannot be excluded might partly influence the different pattern of association between social support and subjective health seen in men and women.

In present study, social support was lower in men than in women, although no significant difference in the proportion of good health was observed between men and women. More social support leads to improved subjective health, which in turn reduces the chance of dying [19]. In this study, we found a significant relationship between social support

and subjective health in men, but not in women, and this finding remains statistically significant when other factors are controlled. This suggests that men may gain better health status at a lower level of social support than women. According to Shye et al. [12], network size affected men's mortality risk indirectly through their health status, while no indirect effect was found for women; if social support has directly protective effects or a stress-buffering effect, this might become evident in women only at relatively higher levels of network support. Women may also provide rather than experience indirect effects that would lead to reduced mortality through improved health status [12]. If the mortality would be replaced with health status, our results might be explained by these findings.

We found that the direct effect of social support on subjective health was more larger in men (82.6%) than in women (23.0%), implying that social support could be independently related to subjective health for men, while indirectly through such other factors other than social support for women. Accordingly, these findings may explain, in part, the gender differences in the relationship between social supports and subjective health observed in this study. In women, about 80% of the indirect effect of social support was explained by physical and mental impairments, suggesting that social support in women may affect indirectly subjective health through their physical and mental health status. In women, rates of decline in physical function are higher in men [28]. Furthermore, depressive symptoms are more common in elderly women than in men [29]. These findings may lead to an explanation that the effect of physical and mental health status being the indirect effect of social support would be exhibited spuriously more strongly rather than social support being the main effect, not that social support had essentially no association with subjective health. On the other hand, in this study, women had no significant relationship between social support and subjective health, although women had a higher level of social support than men.

This may be because the manner and the level of threshold effect of social support are different for men and women: women may also provide rather than experience, and men need a lower threshold of social support than women to gain better subjective health.

Certain limitations of the present study should be noted. First, the study employed cross-sectional data, precluding any assumptions concerning causality. We cannot conclude with certainty whether social support can predict subsequently subjective health regardless of the direct or indirect effect in both genders. Moreover, subjective health and social support might have changed over time. Further analysis of longitudinal data should be necessary to clarify gender differences in the relationship between changes in level of social support and those in subjective health. Another limitation to this study is its reliance on self-report data on subjective health and social support. Systematic error may also be present because it is probable that some

respondents over- or underreported their subjective health or social support. Accordingly, it is quite likely that the manner of providing a response, that is, social desirable answer, may also affect our results. In our study, however, the effect of social desirability to the relationship would not be so large, because the relationship of social support with subjective health was similar to previous studies.

In conclusion, the most important findings of this study are the gender differences in the nature of the relationship between social support and subjective health in elderly population. This suggests that social support indirectly affected women's subjective health via its effect on physical or mental health status, while directly and beneficial effect for men's subjective health at a relatively lower level of social support. These findings underline the need for a gender-specific approach to further research on this subject. To identify whether social support has a beneficial effect for subjective health for men and women, longitudinal research should be needed to explore gender differences in the relationship between the change in the amount of social support and subsequently subjective health.

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Subjective Usefulness and 6-Year Mortality Risks Among Elderly Persons in Japan

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Several studies have demonstrated that the loss of a sense of one's own self-worth has an influence on the health status, psychological functioning, and quality of life in the aged. We used longitudinal data from 784 elderly residents (mean age = 73 years) to examine the relationship between subjective usefulness and 6-year mortality. We hypothesized that subjective usefulness is an important indicator of quality of life among the elderly population, and subsequently of mortality. We elicited information on subjective usefulness at baseline by using a self-administered questionnaire. Results of longitudinal analyses showed that subjective usefulness may be significantly associated with self-rated health and subsequent mortality. This indicates that subjective usefulness plays an important role in enhancing survival in the elderly population.

RECENTLY, older adults have been encouraged to participate in activities that make use of their skills and abilities in their use of free time as a result of a higher life expectancy, and the number of those actively participating in social activities and volunteer work (older adults who are healthy and active are called "Silver" in Japan) has increased (The Cabinet Office in Japan, 2002). Japanese society has traditionally had a general atmosphere in which older adults often take care of their subordinates in both social and personal matters. Moreover, older Japanese adults have a deep-seated feeling that they do not forget the favors received from others, and they advocate returning favors. This may result from the expression of a fundamental desire to do something useful for others rather than for oneself alone in old age. Such a sense, that is, one's usefulness to others, is also reported to affect the level of psychological functioning and quality of life, and it decreases the risk of morbidity (Ekerdt, Bosse, & Levkoff, 1985).

Several cross-sectional studies have demonstrated that such subjective usefulness is strongly related to physical and psychological health, and it may be a good predictor of overall well-being (Bachman, 1970; Butler & Gleason, 1985; Ranzijn, Keeves, Luszcz, & Feather, 1998; Ryan & Frederick, 1997; Ryff, 1989). These findings strongly suggest that subjective usefulness may be a key factor in maintaining and promoting self-rated health and general well-being. Recently, researchers reported self-perceptions of aging including the concept of usefulness to influence longevity and to predict functional health over an 18-year period (Levy, Slade, Kunkel, & Kasl, 2002). However, they have not prospectively commented on the effect of the sense of one's usefulness alone on longevity among healthy older adults. Therefore, we investigated such relationships between the evaluation of subjective usefulness and mortality among older participants in Japan.

METHODS

Participants

The participants of this study were 825 noninstitutionalized individuals aged 65 years and older (representing a 90%

response rate) living in a rural town in Japan who agreed to in-home face-to-face interviews. Among them, the number of subjects analyzed was 784 individuals who completed the questionnaire items on subjective usefulness at a baseline. The interviews were conducted by six well-trained district welfare commissioners during March and June of 1995.

Measures

We determined the vital status (alive or deceased) of study participants during 6 years of follow-up from August 1995 through September 2001, and we confirmed deaths both by inquiries of older participants or family members and by obtaining data from official death certificates. The completion rate of follow-up on deaths was almost 100%. Interviewers obtained informed consent from each study participant after a verbal explanation of the study purpose and methods, and they gathered a review of personal data at the end of follow-up.

We assessed subjective usefulness by using the following single-question item: "How do you evaluate your own present usefulness to others and society?" The response categories were "quite a bit," "some," "a little," and "not at all." Because there was low frequency in the "not at all" category, we classified our participants into three categories: "quite a bit," "some," and "a little or not at all." In multivariate analyses, we further categorized subjective usefulness as "high" (quite a bit or some) versus "low" (a little or not at all).

We assessed self-rated health on the basis of responses to this statement: "How do you evaluate your present health (excellent, good, fair, or poor)?" We considered those who responded "excellent" or "good" to be in good health, whereas we judged those who responded "fair" or "poor" to be in suboptimal health.

The sociodemographic variables included in this study were age, gender, and marital status (married vs unmarried). We assessed medical status on the basis of the presence or absence of the following chronic medical conditions during the previous 12 months: hypertension, diabetes mellitus, angina, myocardial infarction, stroke, bronchitis, asthma, hepatitis B or liver

disease, anemia, circulatory troubles in the extremities, and hip fractures or arthritis. We considered these conditions to be present if participants reported having been diagnosed by a doctor or if they had been hospitalized for those conditions.

We assessed physical activities on the basis of response to this statement: "How often do you exercise in your usual day?" Responses presented were "less than once a week," "1-2 times per week," "3-4 times per week," and "almost everyday." We considered those who responded "less than once a week" or "1-2 times per week" to be inactive, whereas we categorized those who responded "3-4 times per week" or "almost everyday" as active. We classified the number of medical conditions as either 0 or 1 or more. We defined symptomatic depression as two or more of the following symptoms: feeling lonely, having difficulty in falling asleep, being unwilling to do things or having a lack of energy, feeling depressed, and experiencing nervous tension or nervousness. We assessed contact with network resources on the basis of responses to this statement: "How often do you talk with friends and relatives on a typical week?" The possible responses were "almost every day," "once or twice a week," "rarely," and "never." Because there was a low frequency of responses in the "never" category, we grouped it into a single category with the "rarely" responses. We defined social role as one or more of the following activities: volunteering, attending a community service organization, and making a financial contribution to a community association.

Statistical Analysis

We estimated the survival functions for each covariate by using the Kaplan-Meier product-limit method. We assessed the association between subjective usefulness and mortality by using the odds ratio (OR) and 95% confidence interval (CI) in Cox's hazard model in which subjective usefulness was defined in the terms of categorical variables. In these analyses, we considered the participant's age at a baseline for each participant, and we censored participants at the last time their status "alive" or "deceased." We then used four sequential hazard models to analyze the relationships between self-perceived usefulness and mortality. We performed all calculations with SPSS Version 10.0 for Windows (Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL), using the LOGISTIC procedures.

RESULTS

Among our 784 participants, 148 (18.9%) were deceased and 636 (81.1%) were alive at the follow-up in 2001. Among those who completed the follow-up, the survival times ranged from 0.5 to 5.9 years, with the mean survival time being 5.5 years ($SD = 1.1$). At baseline, 243 (32.4%) participants evaluated their subjective usefulness as "quite a bit"; 369 (49.2%) as "some"; and 137 (18.3%) as "a little or not at all." Figure 1 shows the Kaplan-Meier survival curves for subjective usefulness unadjusted for potential confounders. Table 1 shows the crude hazard risk of mortality by sociodemographic characteristics and other covariates. There was a gradient of increasing risk of mortality associated with a worsening subjective usefulness evaluation. The crude hazard risk of mortality was the highest in those who rated their usefulness as

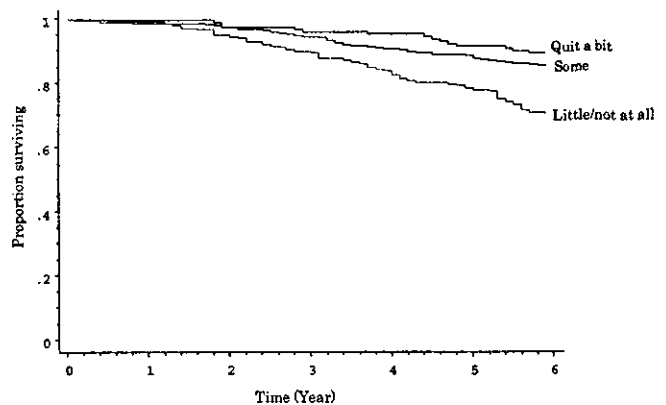


Figure 1. Kaplan-Meier survival curves for subjective usefulness among Japanese persons aged 65 years and older.

Table 1. Univariate HRs and 95% CIs of Mortality During 6 Years Among Japanese Elders

Characteristic	No.	% Death	Crude HR	<i>p</i>	95% CI
Gender					
Male	337	23.1	1.00		
Female	447	15.6	0.61		0.43-0.88
Age groups (years)					
65-69	309	9.2	1.00		
70-74	197	12.4	1.35		0.76-2.40
75-79	149	26.7	3.49		2.06-5.94
≥80	129	42.5	7.09		4.22-11.9
Trend-test <i>p</i> value				.007	
Marital status					
Married	452	16.4	1.00		
Unmarried	300	23.0	1.52		1.05-2.22
Self-perceived health					
Excellent-good	496	16.5	1.00		
Fair-poor	246	26.7	1.85		1.20-2.89
Comorbidity					
No	254	11.8	1.00		
Yes	485	22.9	1.67		1.15-2.43
Depressive symptom					
No	491	13.6	1.00		
Yes	272	20.2	1.61		1.06-2.46
Contact with neighborhood					
Almost everyday	134	10.4	1.00		
1-2 times/week	508	18.9	1.81		1.39-16.7
Rarely-never	114	35.7	4.76		0.78-7.14
Trend-test <i>p</i> value				.01	
Social roles					
1 or more	271	13.7	1.00		
None	385	20.3	1.83		1.15-2.94
Self-assessed usefulness					
Quite a bit	152	10.4	1.00		
Some	379	14.4	2.50		1.64-3.70
A little-not at all	253	29.4	3.57		1.92-6.67
Trend-test <i>p</i> value				.000	

Note: CI = confidence interval; HR = hazard ratio.

“a little or not at all,” followed by “some,” compared with “quite a bit.”

The risk was also higher in men than in women, in those who were unmarried rather than married, in those who rated their health as fair or poor rather than as excellent or good, in those who were depressed rather than nondepressed, in those who had any chronic diseases rather than in those with none, and in those who had less rather than frequent contact with neighborhood organizations. We found that the odds ratio for subjective usefulness (OR = 3.57; 95% CI = 1.92–6.67) was higher than that for engaging in social roles as the index of helping others (OR = 1.83; 95% CI = 1.15–2.94).

Table 2 shows the hazard risks and confidence intervals for mortality in 2001 associated with 1995 subjective usefulness. In all four models, subjective usefulness was shown to be protecting against mortality. In the fully adjusted model (Model 4), the adjusted hazard ratio of mortality was 2.24 times higher among those who rated their usefulness as “a little or not at all” compared with those with a “quite a bit” rating, which amounted to a statistically significant difference.

DISCUSSION

In this study, which followed a cohort of 825 noninstitutionalized individuals aged 65 years and older to examine the relationship between subjective usefulness and mortality for 6 years, we found that a greater sense of one's usefulness was protective against mortality, even after we adjusted for subjective health and other variables. To our knowledge, this is the first study to demonstrate a significant relationship between subjective usefulness and mortality in older persons.

A methodological issue arose from the fact that we measured subjective usefulness with a single-item question, not by using a multidimensional scale including complex terms. This is because a single-item question is more likely to simply and directly assess the sense of subjective usefulness than a multidimensional scale. Moreover, we found high agreement in the degree of subjective usefulness between a single-item question and the six-item scale proposed by Ranzijn and colleagues (1998) among 100 individuals who were randomly selected from all study participants (Spearman correlation coefficient, $r = .76$; $\kappa = 0.81$). These findings suggest that the effect of using a single-item question does not make a major difference.

In this study, we cross-sectionally demonstrated a significant positive relationship between subjective usefulness and self-rated health. Dua (1995) reported that negative affect was the

best predictor of prospective health. According to Ryan and Frederick (1997), such subjective vitality and subjective usefulness were found to be highly salient and strongly related to physical and psychological health. Accordingly, these findings might provide a more likely explanation for our results.

We also observed an inverse relationship between subjective usefulness and mortality. A number of studies have also demonstrated that poor self-rated health is significantly associated with an increased mortality (Blazer & Houpt, 1979; Heidrich, Liese, Lowel, & Keil, 2002; Heistaro, Jousilahti & Lahelma, 2001). Accordingly, it is quite likely that the relationship between subjective usefulness and mortality may be confounded by self-rated health. However, significant relationships remained even after adjustment for self-rated health, indicating that subjective usefulness affects the mortality among older adults independent of self-rated health.

A few studies have demonstrated that volunteering exerts a protective effect against mortality among older adults (Chambre, 1993; Hunter & Linn, 1980–1981; Musik, Herzog, & House, 1999; Ward, 1979). According to Stevence (1980), involvement with others is significantly related to feeling useful. Moreover, it appears that subjective usefulness could also provide a resource of energy or vitality for all physical, psychological, and social activities, and it could reinforce the desire to help others through volunteering. Nakanishi and colleagues (1998) reported that the sense of “life worth living” (*ikigai*) is reflective of an active physiological and psychological profile. However, no studies have compared the impact of subjective usefulness and engagement in helping others on the rate of mortality. We found that the odds ratio for subjective usefulness was higher than that for engaging in social roles as the index of helping others. Our finding strongly suggests that subjective usefulness may be more beneficial to long-term survival among older adults than social benefits such as volunteering.

Some limitations of this study should be noted. First, all the information was obtained by one-on-one interviews. It is well known that respondents tend to give “socially desirable” answers to interview-administered questionnaires, compared with self-administered questionnaires (Okamoto et al., 2002; Siemietycki, 1979). In addition, systematic errors may also be present because some respondents probably overreported or underreported their subjective usefulness. Accordingly, it is quite likely that “socially desirable” answers may also have partly influenced our results. Second, subjective usefulness

Table 2. Adjusted HRs and 95% CIs of a 6-Year Mortality for Japanese Elders

Model	Subjective Usefulness			Trend-Test <i>p</i> Value
	Quite a Bit Adjusted HR (95% CI)	Some Adjusted HR (95% CI)	A Little-Not at All Adjusted HR (95% CI)	
1. Age, gender, and marital status	1.00	1.45 (0.74–2.84)	2.42 (1.24–4.70)	.003
2. Model 1 + self-rated health	1.00	1.39 (0.71–2.74)	2.25 (1.15–4.39)	.07
3. Model 2 + comorbidity and symptomatic depression	1.00	1.17 (0.54–2.31)	2.02 (0.99–4.14)	.02
4. Model 3 + contact with neighborhood and social roles	1.00	1.28 (0.83–2.42)	2.24 (1.166–4.26)	.01

Note: HR = hazard ratio; CI = confidence interval.

appears to lead to improved behavioral patterns and enhanced general health status, thus helping older persons function more effectively both at home and in society. However, an inverse relationship between subjective usefulness and mortality remained even after adjustments for the degree of self-rated health and other confounding variables. In addition, we used information collected at baseline to predict mortality up to 6 years later. Subjective usefulness may have changed during follow-up periods. However, in the present study, we observed that the level of subjective usefulness was virtually stable over 6 years among surviving older adult participants (Spearman correlation coefficient, $r = .94$; $\kappa = 0.92$).

Taking previous studies into account, our findings suggest that the beneficial effect of the feeling of usefulness on longevity would be generalizable to countries other than Japan. When older Japanese adults describe their own usefulness or importance, they often use the following statement: "Things don't proceed if I am not here." This suggests that the source of the feeling of usefulness is having a strong sense of being at the center of the world.

In conclusion, the findings of the present study suggest that subjective usefulness is likely to have the beneficial effects of enhancing or promoting better health status and well-being in later life and reducing mortality. However, little is known about the relationship between subjective usefulness and mortality through changes in self-rated health among older adults. Further longitudinal studies are needed to better understand whether and how subjective health is related to person-specific changes in self-rated health, and subsequently to mortality in older adults.

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