

The Usefulness of Day-Service in Maintaining General Nutritional Status in Elderly Japanese: A Longitudinal Study

TOMOKO NISHIWAKI,¹ KIMIKO UENO,² MARIKO HASEGAWA³ and KAZUTOSHI NAKAMURA⁴

¹Faculty of Health Care, Tokyo Healthcare University, Tokyo, Japan

²Department of Nursing, Faculty of Medical Technology, Teikyo University, Tokyo, Japan

³Welfare Section, Minamiuonuma City Government Yamato Branch, Minamiuonuma City, Japan

⁴Department of Community Preventive Medicine, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

NISHIWAKI, T., UENO, K., HASEGAWA, M. and NAKAMURA, K. *The Usefulness of Day-Service in Maintaining General Nutritional Status in Elderly Japanese: A Longitudinal Study*. Tohoku J. Exp. Med., 2007, **211** (1), 15-21 — Day-service, commuting service for elderly people requiring care at home, is one healthcare option in Japan. To date, however, there exist no studies that have examined the effects of day-service use on health outcomes in Japan. The objective of the present longitudinal study was to determine whether there is an association between day-service use and various physical and mental health outcomes in elderly people requiring care. The subjects were 61 elderly persons who required between 25 and 49 min of assistance per day and used long-term care insurance. Measurements included demographic characteristics, activities of daily living, frequency of day-service use, body weight, height, grip strength, thigh muscle volume, degree of depression (Geriatric Depression Scale), the mini-mental state examination, and serum albumin and blood hemoglobin levels in the baseline and follow-up surveys two years later. In the day-service user group, the mean changes in serum albumin concentrations using day-service once, twice and three \leq times/week were -0.2 , -0.3 , and 0 g/dl, respectively, and the mean changes in blood hemoglobin were -0.7 , -0.5 , and 0.2 g/dl, respectively. The two-year change in serum albumin concentrations was less ($p = 0.024$) in subjects using day-service “three \leq times” (0 g/dl) than “twice” (-0.3 g/dl). The two-year change in blood hemoglobin was also less ($p = 0.043$) in subjects using day-service “three \leq times” (0.2 g/dl) than “twice” (-0.5 g/dl). The present study has shown that frequent use of day-service is useful in maintaining general nutritional status in elderly people.

——— albumin; community health services; cohort studies; elderly; hemoglobin

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Day-service, commuting service for elderly people requiring care at home, is one healthcare option, administered by local governments

throughout Japan. Day-service consists of a number of services, including bathing and meal service (with assistance when needed), consultation,

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Correspondence: Kazutoshi Nakamura, M.D., Division of Social and Environmental Medicine, Department of Community Preventive Medicine, Niigata University Graduate School of Medical and Dental Sciences, 1-757, Asahimachi-dori, Niigata 951-8510, Japan.

e-mail: kazun@med.niigata-u.ac.jp

advice for daily life, and health check-ups (Health and Welfare Statistics Association 2005). Many of these services are provided in local day-service facilities, and the proliferation of day-service centers in Japan may eventually decrease use of nursing homes.

The use of day-service may have various beneficial health effects in the elderly. It has been hypothesized that elderly people who use day-service bathe more frequently, eat meals more regularly, engage in more physical or recreational activity, and have more frequent social contact. Consequently, those who use day-service have a better mental state, a better nutritional and physical status, and they form better social networks than those who do not use day-service. At present, only one study, using questionnaire surveys, has reported an association between the use of day-service and physical and mental conditions in the disabled elderly (Watanabe et al. 1994). However, no study has used medical examinations to investigate the potential health effects of day-service use in this population.

The objective of the present longitudinal study was to determine whether there is an association between day-service use and various physical and mental health outcomes.

SUBJECTS AND METHODS

Subjects

We targeted 518 elderly persons living at home, who were approved for care in October 2002 in the town of Yamato, Japan. The baseline and follow-up survey, including medical examinations and interviews, were conducted between January 2003 and April 2003 and January 2005 and March 2005, respectively. Of the 518 potential participants, 205 agreed to participate in the baseline survey. Of those 205, 42 died, 21 were institutionalized, eight moved away during the two-year follow-up, and eight refused to participate in the follow-up survey. Consequently, 118 persons participated in the follow-up survey. The study sample was restricted to people who were classified at either the lowest Care level or Care level 1 according to the official approval by the local governments. The lowest Care level and Care level 1 were thought to be equivalent to 25-30 and 25-29 min assistance, respectively (Ito and Miyamoto 2003). Care level classification reflects the ability to perform the

activities of daily living (ADL) and low ADL levels are believed to affect health outcomes greatly. Most (93.3%) of the day-service non-users were at the lowest Care level or Care level 1, while the Care levels of day-service users varied widely. To make the day-service users and non-users groups comparable, we restricted the sample to people at Care level 1 or less. Of the 65 people at Care level 1 or less, four changed their day-service use (i.e., newly began to use day-service) and were therefore excluded. Sixty-one elderly persons (37 day-service users and 24 non-users) were included in the final statistical analysis. For the day-service users, the survey was conducted at the subject's day-service facility, and for the day-service non-users, we visited the subject's homes to conduct the survey. Protocols for the baseline and follow-up surveys were conducted in the same manner. Informed consent was obtained from all the subjects prior to their participation in the survey. This study was approved by the Ethics Committee of Niigata University School of Medicine.

Day-service

The four day-service centers in Yamato, Japan provided a variety of services, including bathing, lunch, snacks, recreational activities, and rehabilitation programs, with assistance. Recreational activities were usually conducted in groups, and included sports, music, gardening, handcraft, and cooking. Day-service users stayed in the centers for 6 or 8 daytime hours.

Measurements

Demographic characteristics, level of dependence for ADL, frequency of day-service use, body weight, height, muscle strength, muscle volume, mental status examination, and blood testing were all conducted at the beginning of the study to establish baseline measurements and then again during the follow-up period. Details of the methods used to obtain these measurements were described previously (Nishiwaki et al. 2005).

Frequency of day-service use was classified as zero, one, two, or three \leq times/week. Subjects whose frequency of use was "zero" times/week were defined as non-users. ADL levels were evaluated, using the Barthel index (Wade and Collin 1988), which consists of the following 10 items: feeding, transfers (bed to chair and back), grooming, toilet use, bathing, mobility (on level surfaces), stairs, dressing, bowels, and bladder. An individual's total score reflects his/her required level of assistance and thus his/her disability. The score ranges

from zero (the maximum level of assistance required) to 100 (the minimum level of assistance required) points. Evaluation of the level of assistance needed for ADL for 61 subjects was assessed by direct subject interviews.

Body height was estimated as twice the value of the left arm span (Kwok and Whitelaw 1991) because the height in the standing position could not be accurately measured in the subjects. Body weight was measured with a digital weighing scale (BWB-200S, Tanita Corporation, Tokyo) while the subjects wore only light underclothes. Body mass index (BMI) was calculated by dividing the body weight in kg by the square of the height in meters.

Grip strength was measured with a digital hand dynamometer (T.K.K.5401, Takei Scientific Instruments Co., Ltd., Niigata) once each for the right and left hands. The higher value between the two measurements was adopted as the grip strength. Thigh muscle volume was measured with a bioelectrical impedance muscle analyzer (Muscle- α , Art Haven 9, Kyoto) (Miyatani et al. 2001).

Cognitive impairment was evaluated using the minimal state examination (MMSE) (Folstein et al. 1975), in which a lower score indicates a more severe cognitive impairment. Depression was evaluated using the geriatric depression scale (15-item version: GDS-15) (Niino et al. 1991; Herrmann et al. 1996), in which the subjects answer "Yes" or "No" to the 15 questions in the scale; a high score is indicative of depression. These psychological examinations were conducted by nurses who were trained and proficient in these examinations.

Blood testing was conducted using blood specimens collected in the non-fasting state. The serum albumin level and hemoglobin level were measured (BML, Inc., Tokyo) by the BCG method and SLS-HB method, respectively.

Statistical analysis

Continuous variables were expressed as means and standard deviations (s.d.). The grip strength and GDS-15 was subjected to logarithmic transformation to obtain a normal distribution for the statistical tests. Differences in mean variables between the baseline and the follow-up were analyzed by the paired *t*-test, and differences in mean variables between day-service users and non-users were analyzed by Student's *t*-test. Adjusted differences in mean variables between day-service users and non-users were analyzed by analysis of covariance (ANCOVA) with age and Barthel index as covariates. Comparisons of mean values of health outcomes among

frequencies of day-service use (once, twice, three \leq times/week) were tested by ANCOVA with age and Barthel index as covariates, with Bonferroni's multiple comparisons for any two groups. The SAS statistical software package (release 8.02) was used for the statistical analysis. $p < 0.05$ was defined as statistically significant.

RESULTS

The mean age of the 61 subjects was 84.0 (s.d. 6.8) years. The 37 day-service users consisted of 28 women and 9 men, and the 24 day-service non-users consisted of 18 women and 6 men. Fifteen subjects (10 day-service users and 5 non-users) had stroke, 12 (9 day-service users and 3 non-users) had cardiovascular diseases, 5 (3 day-service users and 2 non-users) had diabetes mellitus, 23 (14 day-service users and 9 non-users) had hypertension, one (day-service user) had rheumatoid arthritis, and 14 (8 day-service users and 6 non-users) had osteoarthritis, with no significant difference in prevalence of any disease between day-service users and non-users.

Table 1 shows baseline characteristics of the two groups as mean values (with s.d.). Day-service users were, on average, five years older, and tended to have lower Barthel index and MMSE scores than non-users. The two-year changes in the values between the baseline and follow-up, by use of day-service, are also shown in Table 1. There were significant decreases over the two-year follow-up period in weight (day-service user only), thigh muscle volume, MMSE (day-service user only), and serum albumin concentrations. However, there were no statistically significant differences between the two groups in the magnitude of the change in any of the variables, whether analyzed with crude or adjusted data.

Table 2 shows mean values (s.d.) of characteristics of the 37 day-service users at baseline and their changes during the two-year follow-up, by frequency of day-service use. Mean values in serum albumin and hemoglobin concentrations at baseline and 2-year follow-up differed significantly between people who used day service twice or less and those who used the service three \leq

TABLE 1. Characteristics of all 61 subjects at baseline and their changes after two years of follow-up.

	Baseline values				Two-year changes			
	Day-service		<i>p</i> value*	Adjusted <i>p</i> value†	Day-service		<i>p</i> value*	Adjusted <i>p</i> value†
	Users (<i>n</i> = 37)	Non-users (<i>n</i> = 24)			Users (<i>n</i> = 37)	Non-users (<i>n</i> = 24)		
Age	86.0 (5.1)	81.0 (8.0)	0.010	-	-	-	-	-
Height (cm)	151.5 (8.9)	152.2 (7.9)	0.758	0.800	-	-	-	-
Weight (kg)	46.9 (10.0)	48.0 (8.7)	0.649	0.389	-1.6‡ (3.0)	-1.0 (4.4)	0.612	0.945
Body mass index (kg/m ²)	20.4 (3.7)	20.8 (3.5)	0.692	0.519	-	-	-	-
Barthel index	81.8 (14.3)	89.0 (12.9)	0.051	-	-6.9 (26.0)	-0.8 (10.5)	0.211	-
Grip strength (kg) [§]	15.8 (7.3)	16.6 (4.3)	0.230	0.644	0.1 (4.3)	0.3 (2.4)	0.772	0.683
Thigh muscle volume (kg)	6.0 (1.2)	6.5 (2.1)	0.256	0.346	-0.6‡ (0.5)	-0.5‡(0.7)	0.549	0.686
GDS-15	3.9 (3.2)	3.9 (2.7)	0.958	0.470	-0.5 (2.7)	0.4 (2.9)	0.237	0.349
MMSE [¶]	23.6 (3.6)	25.3 (3.7)	0.093	0.125	-2.2‡(5.8)	-0.2 (4.9)	0.189	0.444
Serum albumin (g/dl)	4.1 (0.3)	4.0 (0.3)	0.282	0.083	-0.1‡(0.3)	-0.1‡(0.2)	0.867	0.407
Blood hemoglobin (g/dl)	13.0 (1.8)	12.9 (1.4)	0.844	0.473	-0.3 (0.9)	-0.3 (1.2)	0.911	0.755

Variables of grip strength and GDS-15 were log-transformed in calculating *p* values (presented data are unadjusted values).

*Student's *t*-test for mean values between users and non-users of day-service.

†Adjusted for age and Barthel index at the baseline by ANCOVA.

‡Variables having a significant 2-year change tested by paired *t*-test (*p* < 0.05).

§One value missing. ¶Four values missing.

GDS-15, Geriatric Depression Scale, 15-item version; MMSE, Mini-Mental State Examination.

times/week. The changes in serum albumin and blood hemoglobin concentrations according to frequency of day-service use are shown in Fig. 1. The mean changes in serum albumin concentrations for subjects using day-service once, twice, and three \leq times/week were -0.2, -0.3, and 0 g/dl, respectively. The mean changes in blood hemoglobin for subjects using day-service once, twice, and three \leq times/week were -0.7, -0.5, and 0.2 g/dl, respectively. ANCOVA showed that the frequency of day-service use was significantly linked to the two-year changes in serum albumin concentrations (*p* = 0.0128), with statistically significant differences between "twice" and "three \leq times". ANCOVA also showed that the frequency of day-service use was linked to blood hemoglo-

bin (*p* = 0.0081), with statistically significant differences between "twice" and "three \leq times".

DISCUSSION

This study did not demonstrate a significant difference in any of the outcomes measured between users and non-users of day-service. This may be associated with the health characteristics of the day-service non-users and/or a bias in selecting subjects, especially day-service non-users. That is, the day-service non-users were five years younger, on average, and tended to have higher ADL levels and better cognitive function. This suggests that day-service non-users were in better physical and mental condition than users, which could have favorably affected two-

TABLE 2. Characteristics of the 37 day-service users at baseline and their changes after two years of follow-up.

	Baseline values				Two-year changes			
	Frequency of day-service use		<i>p</i> value*	Adjusted <i>p</i> value†	Frequency of day-service use		<i>p</i> value*	Adjusted <i>p</i> value†
	≤ 2 times/wk (<i>n</i> = 22)	3 times/wk ≤ (<i>n</i> = 15)			≤ 2 times/wk (<i>n</i> = 22)	3 times/wk ≤ (<i>n</i> = 15)		
Age	86.1 (5.7)	85.9 (4.1)	0.876	-	-	-	-	-
Height (cm)	152.7 (8.9)	149.7 (8.6)	0.332	0.311	-	-	-	-
Weight (kg)	48.2 (9.7)	45.0 (10.4)	0.359	0.345	-1.8‡(3.2)	-1.3 (2.8)	0.626	0.677
Body mass index (kg/m ²)	20.6 (3.7)	20.0 (3.9)	0.621	0.634	-	-	-	-
Barthel index	82.7 (14.9)	80.3 (13.9)	0.625	-	-6.6 (26.3)	-7.3 (28.5)	0.934	-
Grip strength (kg) [§]	17.0 (8.1)	14.1 (5.7)	0.289	0.200	0.3 (4.4)	0.6 (4.3)	0.560	0.640
Thigh muscle volume (kg)	6.2 (1.2)	5.7 (1.3)	0.239	0.159	-0.6‡(0.5)	-0.5‡(0.7)	0.663	0.681
GDS-15	3.4 (3.3)	4.6 (3.1)	0.145	0.165	-0.4 (2.5)	0.5 (3.1)	0.907	0.953
MMSE [¶]	24.9 (2.9)	22.0 (3.9)	0.019	0.029	-2.1 (4.3)	-2.3 (7.3)	0.943	0.916
Serum albumin (g/dl)	4.2 (0.3)	3.9 (0.3)	0.003	0.001	-0.2‡(0.3)	-0.0 (0.3)	0.016	0.016
Blood hemoglobin (g/dl)	13.5 (1.7)	12.2 (1.6)	0.032	0.022	-0.6‡(0.9)	-0.2 (0.7)	0.003	0.004

Variables of grip strength and GDS-15 were log-transformed in calculating *p* values (presented data are unadjusted values).

*Student's *t*-test for mean values between ≤ 2 times and 3 times ≤ users of day-service.

†Adjusted for age and Barthel index at the baseline by ANCOVA.

‡Variables having a significant 2-year change tested by paired *t*-test (*p* < 0.05).

§One value missing. ¶Four values missing.

GDS-15, Geriatric Depression Scale, 15-item version; MMSE, Mini-Mental State Examination.

year changes in some outcomes. In general, healthy elderly people are less likely to need day-service, which could create a selection bias towards a control group that is healthier than the case group. Confounding may also have been an issue. We adjusted for major confounding factors using ANCOVA, but some confounding may nonetheless have remained. An observational study cannot eliminate such biases, and thus interventional studies should be conducted to determine more conclusively whether there is an association between the use of day-service and the outcomes measured in this study.

An important finding of this study was that blood nutritional parameters such as serum albumin and hemoglobin levels declined significantly

less in persons using day-service three or more times/week than in those using day-service less frequently. Although baseline differences in these two parameters may have influenced this finding, it suggests that day service helps elderly people maintain good nutritional status, probably because the day-service centers provide regular meals. In fact, the day-service centers in Yamato offer lunch, supervised by registered dietitians, and regular snacks in the afternoon. The serum albumin concentration is not only a marker for general nutritional status, but also a marker for predicting various health outcomes such as mortality, functional limitation, muscle strength and disability (Klonoff-Cohen et al. 1992; Zuliani et al. 2001; Schalk et al. 2005a). Moreover, it has been

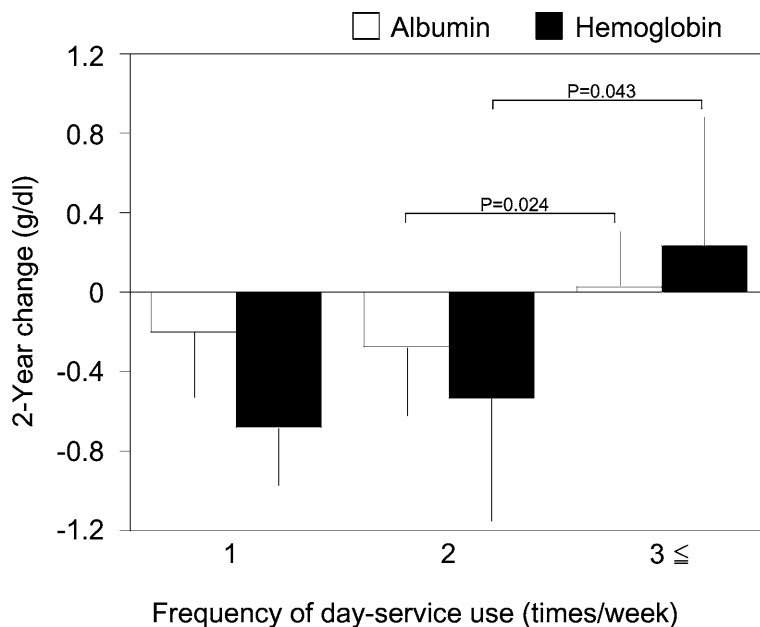


Fig. 1. Two-year changes in serum albumin and blood hemoglobin concentrations, according to frequency of day-service use in the 37 day-service users. The data shown indicate unadjusted mean values with S.D.s. ANCOVA with age and Barthel index as covariates showed that frequency of day-service use was significantly associated with two-year changes in concentration of serum albumin ($p = 0.014$) and blood hemoglobin ($p < 0.001$) concentrations.

reported that changes in serum albumin concentration, within a normal range, are associated with future functional decline (Schalk et al. 2005b). Blood hemoglobin is a marker of anemia and a co-marker of nutritional status with serum albumin in elderly populations (Lipschitz 1994), and it may be associated with anemia-related outcomes, including physical and cognitive functions (Beghe et al. 2004). Day-service may therefore have the potential to lower mortality and prevent age-related diseases or disorders.

The present study did not demonstrate a significant difference in physical and mental conditions among the once, twice and three \leq times/week day-service users. One possible explanation is that day-service users did not use all available services, but only selected certain services and not others. More detailed information on selected services for each subject will be needed to explore effects on physical and mental functions.

This study had several limitations. Most importantly, the sample size in this study was

small, and may have been subject to a selection bias. Accordingly, the results of this study should be confirmed by further studies with a larger and more representative sample. Additionally, the results of this study can only be generalized to elderly people with relatively high ADL levels who require minimal or lower care needs. The results cannot be generalized to those with low ADL levels who require extensive care. A large functional limitation may modify health outcomes significantly.

The present study showed that degrees of day-service use are associated with changes in serum albumin and blood hemoglobin concentrations. This suggests that frequent use of day-service is useful in maintaining general nutritional status in elderly people and that day-service use has the potential to decrease mortality and medical costs. Favorable effects of day-service use on physical or mental functions remain unclear, and therefore further studies should be conducted with a large sample size.

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