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Title of the paper: Comparison of frailty between users and non-users of a day care center using the Kihon Checklist in Brazil

Short running title: *Frailty in users and non-users of day care centers*

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Authors' contributions: All of the authors participated in the development of the research project, analysis and interpretation of data and preparation of the manuscript. Priscila Yukari Sewo Sampaio and Ricardo Aurélio Carvalho Sampaio recruited the subjects and collected the data.

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ABSTRACT

Background/Purpose: Day care centers are rapidly expanding in Brazil to meet the needs of the increasing older population. However, the health profiles of their clients remain unclear. Therefore, this study aimed to investigate and to compare the health conditions of users and non-users of a day care center using a new frailty index, the Kihon Checklist.

Methods: Cross-sectional observational study. We recruited 59 users (mean age 81.1 ± 6.69 years) and 173 non-users (mean age 69.9 ± 7.39 years). The non-users were recruited at a recreational club and municipal health units, and the users were recruited at a day care center for the elderly in Brazil. The measurements consisted of questionnaires regarding sociodemographic and health-related characteristics and the Kihon Checklist.

Results: Compared with the non-users, users had a higher prevalence of frailty ($p < 0.001$) and impairment of all specific domains (instrumental activities of daily living impairment $p < 0.001$; physical inactivity $p < 0.001$; seclusion $p < 0.001$; cognitive deficit $p < 0.001$; and depression $p < 0.001$). The users were also more likely to be frail (OR: 14.226; 95% CI 5.423-37.320; $p < 0.001$), instrumental activities of daily living dependent (OR: 78.845; 95% CI 19.569-317.674; $p < 0.001$), physically inactive (OR:

3.509; 95% CI 1.467-8.394; $p=0.005$), cognitively impaired (OR: 5.887; 95% CI 2.360-14.686; $p<0.001$) and depressed (OR: 5.175; 95% CI 2.322-11.531; $p<0.001$) than the non-users.

Conclusions: The users of the day care center were frailer than non-users; especially with regards to instrumental activities of daily living independence, physical strength, cognitive function and mood. Healthcare workers should use the Kihon Checklist to frequently verify the condition of elderly patients to prevent worsening of frailty.

Key words: frailty, assessment, older adults, day care, community

Introduction

By 2050, the elderly population in Brazil is projected to represent approximately 30% of the total population, making Brazil one of the countries with the largest absolute number of elderly people worldwide.^{1,2} These demographic changes will present a new challenge to the Brazilian health care system.³

In this context, non-institutionalized care modalities that assist frail older persons are emerging in Brazil.⁴ One example is day care centers that offer programs designed to meet the needs of the elderly persons who require supervised care during the day but can return home in the afternoon or evening. Such institutions are rapidly expanding. However, there are few assessments of day care center attendees because of the busy work schedule of the center staffs who do not have time required for the massive assessments for older adults; therefore, the health profiles of the clients and their specific needs remain unclear.

Hence, this study sought to i) investigate the health conditions of the users of a day care center using a new frailty assessment tool known as the Kihon Checklist, a comprehensive and fast questionnaire; and ii) to compare the health profiles of the day care center users with those of elderly community-dwelling non-users of such facilities.

Methods

This is a cross-sectional observational study.

Participants

The inclusion criteria were community-dwelling adults aged 60 years or older, users or non-users of day care services, who were able to respond to the questionnaire independently or by proxy. Subjects who did not match these criteria or did not want to participate were excluded. All subjects received explanations regarding the research procedures and signed an informed consent form.

The non-users of day care services were recruited at a recreational club and municipal health units, whereas the users were recruited at a day care center for the elderly with a maximum capacity of 30 participants per day. The prior criterion to attend the center included the need for support to perform daily activities. The center's professional team consists of medical doctors, nurses, physical therapists, social assistants and volunteers. The main objectives of the institution are to provide proper care for the elderly, offering activities that preserve their dignity and also improve the quality of life of the participants and their families. All institutions were private and located in the same city in southern Brazil. Subject recruitment and data collection were

carried out from June 2012 to April 2013.

The study protocol was approved by the Ethics Committee at Kyoto University Graduate School of Medicine (E-1575).

Assessments

The collected data were 1) sociodemographic information, including age, gender, living structure, educational level and working status; 2) health-related characteristics, including body mass index (BMI), use and number of medications, frequency of medical consultation in the last 6 months, hospitalization in the last year and life satisfaction; and 3) the translated and validated Brazilian Portuguese version of the Kihon Checklist (KCL).⁵

The KCL was developed by the Japanese Ministry of Health, Labor and Welfare based on the needs of the Japanese long-term care insurance system. This checklist is used to screen frail older adults and identify those at higher risk of becoming dependent.^{6,7,8} The checklist is a self-administered questionnaire that comprises 25 yes/no questions divided into instrumental activities of daily living (IADL), physical strength, nutrition, eating, socialization, memory and mood domains. A higher score indicates a more frail health condition. We determined the following

cutoff points: for the KCL total score (sum of the scores of all questions) ≥ 7 points; IADL domain ≥ 3 points; physical domain ≥ 3 points representing physical inactivity; nutrition domain score = 2 points indicating malnutrition; additionally in question number 12 regarding body composition in the same domain, we adopted a cutoff of BMI < 20.5 ; oral domain ≥ 2 points, suggesting oral dysfunction; socialization domain ≥ 1 point, representing seclusion; memory domain ≥ 1 point, suggesting cognitive impairment; and finally, mood domain ≥ 2 points, indicating depression. These cutoff points were adopted based on our previous findings that determined the KCL cutoffs associated with an elevated risk for requiring long-term care insurance service.^{7,9} The time required to answer the KCL is approximately 15 minutes. Further details of the KCL have been previously described.⁵

Statistical analysis

Regarding sociodemographic and health-related characteristics, we analyzed the differences in age, BMI and number of medications between users and non-users of the day care service using an unpaired *t*-test. For categorical variables (i.e., gender, living structure, educational level, working status, use of medication, medical consultation, hospitalization and life satisfaction), we used the chi-square test. For the

variables that exhibited a significant difference ($p < 0.05$) (i.e., living structure, working status and life satisfaction), we dichotomized each item and conducted a chi-square analysis separately for each category. Additionally, we analyzed the differences in KCL domains (mean scores) between groups using ANCOVA adjusted by age.

We calculated the differences in the percentage of frail older adults (according to the KCL cutoff points) between the groups using the chi-square test. We also performed a binary logistic regression analysis adjusted by age and gender with each KCL domain as a dependent variable. For the total KCL score and for each domain, the robust condition was coded as 0 and the frail condition as 1. The non-users group was the reference group. Finally, to verify the variables with higher influence on day care use, we performed a binary logistic regression analysis (using the stepwise method), adjusted by age and gender with “use of day care” (non-users = 0; and users of day care service = 1) as the dependent variable. The dichotomous covariates included were the KCL variables that showed a significance in the previous regression analysis (using the enter method). Statistical significance was set at $p < 0.05$. All analyses were performed using the Statistical Package for the Social Sciences (version 21.0, SPSS, IBM Inc., Chicago, IL, USA).

Results

Sociodemographic and health-related characteristics

A total of 232 elderly subjects met the criteria for the study (community, n=173, mean age 69.9 ± 7.39 years; day care, n=59, mean age 81.1 ± 6.69 years).

Among the 59 users of day care services, 18.6% utilized the day care center once a week, 48.8% twice a week, 25.6% three times per week, 4.7% four times per week, and 2.3% five times per week.

The users of day care services were older, and the majority lived with their children ($p < 0.001$). By contrast, most of the non-users lived with their partners ($p = 0.017$). Additionally, most of the users were retired ($p < 0.001$), whereas some of the non-users were still engaged in volunteer activities ($p = 0.044$). Furthermore, the non-users of day care services had a higher BMI ($p = 0.004$) and were more satisfied with their lives than the users ($p = 0.013$) (Table 1).

Frailty condition

Differences were identified in the total mean KCL score ($p < 0.001$) and the mean KCL scores for all the domains between the two groups. Even when results for each domain were adjusted by age, the users of day care services were found to be more frail than the non-users in terms of IADL ($p < 0.001$), physical strength ($p < 0.001$),

nutrition ($p=0.001$), eating ($p=0.01$), socialization ($p<0.001$), memory ($p<0.001$) and mood ($p<0.001$) (Table 2).

Based on the results that identified frailty using the cutoff points, we observed that the users had a higher prevalence of frailty according to the total KCL score ($p<0.001$) than the non-users. Moreover, the user group contained more subjects with IADL impairment ($p<0.001$), physical inactivity ($p<0.001$), seclusion ($p<0.001$), cognitive deficit ($p<0.001$) and depression ($p<0.001$) (Table 3).

The results of the logistic regression, adjusted for age and gender, confirmed that the users of day care services were more likely to be frail than the non-users. Compared with non-users, the day care users were several times more likely to be frail (OR: 14.226; 95% CI 5.423-37.320; $p<0.001$), IADL dependent (OR: 78.845; 95% CI 19.569-317.674; $p<0.001$), physically inactive (OR: 3.509; 95% CI 1.467-8.394; $p=0.005$), cognitively impaired (OR: 5.887; 95% CI 2.360-14.686; $p<0.001$) and depressed (OR: 5.175; 95% CI 2.322-11.531; $p<0.001$) (Table 4).

We observed that among the five KCL variables found to be significant using the logistic regression analysis enter method (i.e., total KCL score, IADL, physical strength, memory, and mood), only two of them were observed to be significant in the stepwise model, namely, the KCL total score (OR: 5.201; 95% CI 1.645-16.445;

p=0.005) and the IADL domain (OR: 37.368; 95% CI 8.823-158.262; p<0.001) (Table 5).

Discussion

As expected, the day care center users were generally more frail than the non-users, as demonstrated by the differences in the total score on the KCL; additionally, for all specific aspects of health (functional performance in IADL, physical strength, nutrition, eating, socialization, memory and mood) users were more impaired than non-users, as indicated by the KCL domain mean scores.

However, both groups had similar percentages of subjects meeting the cutoffs for frailty regarding nutrition and eating conditions; the participants also had a similar risk of malnutrition and oral disability. These findings may be supported by the BMI measures, which indicated that both groups were in the normal weight range. It was interesting to notice that the KCL mean scores differed between groups; however, when the data were categorized according to the cutoff points, there was no difference between them. Hence, we suggest that both mean scores and cutoff points for the KCL should be used when analyzing data such as these. The mean scores can reveal even slight variations in the data, especially when dealing with small sample sizes, whereas the cutoff points can help to manage large sample sizes with regards to aspects of frailty

in the analyzed population.

Subjects also had a similar risk of seclusion regardless of the use of the day care center, indicating the importance of these centers to meet the social and emotional needs of the elderly, as such centers can alleviate feelings of loneliness, boredom and solitude.¹⁰

The logistic regression results indicated that the need variables for Brazilian users of day care services focus on IADL functional independence, physical strength, cognitive function and mood (Table 4), and this agrees with other researches where a day care center is an option for disabled older people, who have functional disabilities, cognitive deficits or mental frailties.^{11,12} Moreover, apart from general frailty, the most relevant determinant of day care center use detected by logistic regression was functional impairment in IADL. Such functional dependence was already stated as one of the criteria for eligibility for long-term care insurance in Japan.⁷ Maintaining or enhancing the ability to perform daily activities and preventing dependence is the primary goal in the care of vulnerable older adults.¹³

Difficulties in performing IADLs preclude independent living, requiring support that is typically initially provided by the family. Such findings may be linked with the difference in living structure between the groups, considering that the majority

of users lived with their child ($p < 0.001$), who may be their caregiver, while the non-users lived with their partner ($p = 0.017$). In Brazil, the State presents itself as a partner with reduced responsibility, deferring a major role in home care for the disabled elderly,¹⁴ which places high burdens on family caregivers, and this situation was frequently associated with functional impairment, physical disability, mental disorders and depression in the elderly.^{15,16,17} In this context, the family, as primary caregivers, often seek other sources of support to reduce their burden and distress,¹⁸ and these sources include the day care centers.

Interestingly, regardless of day care center use, the use and the number of medications, the frequency of medical consultation and the frequency of hospitalization were similar in both groups. This finding suggests the important role of day care centers from the societal perspective, as they contribute to curtailing national expenditures by delaying or preventing institutionalization, which is much more expensive.¹⁹

In brief, we identified differences in general health and also in all specific aspects of health between users and non-users of a day care service center. The users of the day care center were frailer than the non-users and the users were also more likely to be physically and cognitively frail, to be functionally impaired in IADL and to have depression. These aspects of frailty do not seem to represent the main needs of the

elderly client but more so the main concerns of the family caregivers because of the heavy burden associated with these aspects. All of these negative outcomes may influence life satisfaction as our findings showed that the users of day care service centers were more unsatisfied with their lives ($p=0.003$). Therefore, healthcare workers may use these findings to prevent worsening of frailty, making an effort to improve not only health but also wellbeing.

We verified these important differences between users and non-users of day care service centers using only one assessment, the KCL, a fast and easy assessment that included all of the important domains regarding the needs of the elderly. Therefore, we encourage the use of such assessment as a fast screening for frailty in elderly population and when an alarming condition emerges by the KCL results, we suggest to continue and to deep the investigation using specific instruments for the respective domain.

This study has several limitations that must be noted: i) its cross-sectional design and ii) the recruitment locations. As this study was carried out only in one region of Brazil, the results cannot be generalized to a national population. Additionally, the study included only one day care center. Moreover, we address the possible selection bias that may have occurred considering the predictable higher percentage of frailty in

day care center users group; however, recruiting day care center users was the unique methodology to achieve the purpose of the present study. Further studies including more subjects and institutions from different regions from Brazil are warranted.

Conflicts of Interest Statement

No potential conflicts of interest were disclosed.

Acknowledgments

We thank Nun Kolbe Ayako Tanaka, Sakae Tamura and their team for their major collaboration in the data collection at the day care center; and all the contributors in the data collection at the recreational club led by Jorge Ishii and at the health units led by Graziela Ghazal.

This work was supported by Grants-in-Aid for Comprehensive Research on Aging and Health from the Ministry of Health, Labor, and Welfare of Japan (H24-Tyojyu-001).

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Table 1 Sociodemographic and health-related characteristics of non-users and users of a day care center

Variables		Non-users (n=173)	Users (n=59)	p value
		Valid % (n)	Valid % (n)	
Age	Mean ± SD	69.9 ± 7.39	81.1 ± 6.69	<0.001
Gender	Female	73.4 (127)	71.2 (42)	0.740
Living structure				0.005
	Alone	18.5 (32)	11.9 (7)	0.239
	With partner	31.2 (54)	15.3 (9)	0.017
	With child	20.8 (36)	45.8 (27)	<0.001
	With partner and child	23.1 (40)	18.6 (11)	0.473
	Other	6.4 (11)	8.5 (5)	0.467
Educational level				0.117
	Elementary school	42.6 (72)	55.2 (32)	
	Junior high school	13.6 (23)	12.1 (7)	
	High school	13 (22)	10.3 (6)	
	University	26.6 (45)	12.1 (7)	
	Other	4.2 (7)	10.4 (5)	
Working status				0.006
	Formal Work	11.7 (19)	3.4 (2)	0.079
	Informal Work	9.3 (15)	3.4 (2)	0.179
	Volunteer work	10.5 (17)	1.7 (1)	0.044
	Retirement	68.5 (111)	91.5 (54)	<0.001
BMI	Mean ± SD	26.0 ± 4.53	24.0 ± 5.17	0.004
Medication	Yes	82.1 (142)	84.7 (50)	0.640
Number of medications	Mean ± SD	2.65 ± 2.60	3.39 ± 2.53	0.058
Medical consultation (past 6 months)				0.862
	None	13.6 (23)	15.3 (9)	
	1-2 times	59.2 (100)	59.3 (35)	
	3-4 times	18.3 (31)	20.3 (12)	
	5 times or more	8.9 (15)	5.1(3)	
Hospitalization (last 12 months)	Yes	12.8 (22)	15.3 (9)	0.632
Life satisfaction				0.013
	Satisfied	89.6 (155)	78.0 (46)	0.023
	Fair	6.4 (11)	6.8 (4)	0.910
	Unsatisfied	4.0 (7)	15.3 (9)	0.003

Table 2 Differences in the Kihon Checklist domains' mean scores between users and non-users of the day care center, adjusted for age

Variables	Non-users (n=173)	Users (n=59)	p value
Total KCL Score	4.51 ± 3.62	10.9 ± 3.93	<0.001
IADL Domain	0.40 ± 0.69	2.90 ± 1.36	<0.001
Physical Domain	1.25 ± 1.15	2.02 ± 1.50	<0.001
Nutrition Domain	0.26 ± 0.46	0.47 ± 0.57	0.001
Eating Domain	0.79 ± 0.91	1.10 ± 0.85	0.010
Socialization Domain	0.30 ± 0.48	0.66 ± 0.66	<0.001
Memory Domain	0.67 ± 0.78	1.63 ± 0.87	<0.001
Mood Domain	0.87 ± 1.32	2.12 ± 1.39	<0.001

Table 3 Frail subjects in the non-users and users groups as determined by cutoff points

	Frail non-users (n=173) Valid % (n)	Frail users (n=59) Valid % (n)	p value
Total KCL Score	27.2 (47)	88.1 (52)	<0.001
IADL Domain	1.7 (3)	72.9 (43)	<0.001
Physical Domain	13.9 (24)	37.3 (22)	<0.001
Nutrition Domain	0.6 (1)	3.4 (2)	0.118
Eating Domain	23.7 (41)	24.1 (14)	0.946
Socialization Domain	28.9 (50)	55.9 (33)	<0.001
Memory Domain	49.1 (85)	86.4 (51)	<0.001
Mood Domain	23.1 (40)	64.4 (38)	<0.001

Table 4 Logistic regression analysis (enter method) adjusted for age and gender (n=232)

	Odds Ratio	95% Confidence Interval	p value
Total KCL Score			
Day care center users group	14.2	5.42 – 37.3	<0.001
IADL Domain			
Day care center users group	78.8	19.6 – 318	<0.001
Physical Domain			
Day care center users group	3.51	1.47 – 8.39	0.005
Nutrition Domain			
Day care center users group	0.630	0.035 – 11.5	0.755
Eating Domain			
Day care center users group	0.734	0.315 - 1.71	0.473
Socialization Domain			
Day care center users group	1.75	0.822 - 3.71	0.147
Memory Domain			
Day care center users group	5.89	2.36 - 14.7	<0.001
Mood Domain			
Day care center users group	5.18	2.32 – 11.5	<0.001

Table 5 Logistic regression analysis (stepwise method) adjusted for age and gender (n=232)

	Odds Ratio	95% Confidence Interval	p value
Total KCL Score			
Day care center users group	5.20	1.65 – 16.4	0.005
IADL Domain			
Day care center users group	37.4	8.82 – 158	<0.001