Table 1
Prevalence of Sarcopenia and Low Muscle Mass, Strength, and Physical Performance

	Men						
	Overall	65–69	70–74	75–79	80–84	85–89	*P* for Trend
	n = 568	n = 76	n = 190	n = 172	n = 82	n = 48	
Sarcopenia	124 (21.8)	2 (2.6)	10 (5.3)	40 (23.3)	36 (43.9)	36 (75.0)	<.001
Low muscle mass	218 (38.4)	16 (21.1)	54 (28.4)	64 (37.2)	48 (58.5)	36 (75.0)	<.001
Low strength	200 (35.2)	10 (13.2)	28 (14.7)	70 (40.7)	50 (61.0)	42 (87.5)	<.001
Low physical performance	24 (4.2)	0 (0.0)	2 (1.1)	6 (3.5)	8 (9.8)	8 (16.7)	<.001
	Women						
	Overall	65–69	70–74	75–79	80–84	85–89	*P* for Trend
	n = 1314	n = 278	n = 372	n = 414	n = 180	n = 170	
Sarcopenia	290 (22.1)	32 (11.5)	44 (11.8)	112 (27.1)	64 (35.6)	70 (54.3)	<.001
Low muscle mass	508 (38.7)	68 (24.5)	112 (30.1)	178 (43.0)	100 (55.6)	50 (71.4)	<.001
Low strength	468 (35.6)	64 (23.0)	72 (19.4)	170 (41.1)	112 (62.2)	50 (71.4)	<.001
Low physical performance	54 (4.1)	10 (3.6)	6 (1.6)	8 (1.9)	16 (8.9)	14 (20.0)	<.001

Values are in n (%).

OR = 5.30) than nonsarcopenic older adults. In a similar study conducted in Italy, 27.3% of participants with sarcopenia and 9.8% of participants without sarcopenia experienced falls over a 1-year period (hazard ratio = 3.45).[34] Studies have identified physical frailty as the risk factor for falls and fear of falling in older adults.[35,36] It is possible that a vicious cycle of sarcopenia can lead to lower physical performance and the resulting changes in physical ability can lead to a higher incidence of falls and greater fear of falling.

Sarcopenia is associated with adverse health outcomes. For example, Janssen et al[37] showed that the estimated direct health care cost related to sarcopenia was $18.5 billion in the United States in 2000. Furthermore, Landi et al[38] showed that 67.4% of participants with sarcopenia and 41.2% of participants without sarcopenia died during a 7-year follow-up in a study of older adults aged 80 years and older (hazard ratio = 2.95). Our study showed that sarcopenia is highly prevalent among adults aged 80 years and older. Because older adults are the greatest consumers of health care and have a high risk of death, it is very important to begin prevention of sarcopenia early, possibly before the age of 65.

There were several limitations to this study that warrant mention. First, the study design was cross-sectional and no outcome data are available. Further research with a longitudinal design is required to clarify whether sarcopenia determined by our algorithm can predict adverse health outcomes in Japanese older adults. Second, the SMI measurement was estimated using BIA, a method not recommended to assess muscle mass by the EWGSOP. However, it is not feasible to measure muscle mass in community-dwelling older adults using dual-energy x-ray absorptiometry (DEXA), so BIA is a more practical screening method to use in large samples, especially in a community setting. However, to determine the specific effect of an intervention, a more accurate measurement, such as DEXA, computed tomography, or magnetic resonance imaging, should be used in future studies. Third, serum data were not measured. Therefore, the relationship between sarcopenia and IGF-1 could not be determined. Finally, the presence of sarcopenia might not be able to predict falls in older adults, as this study was based on the participants having experienced a fall in the previous year. Further study is required to confirm our findings in participants with sarcopenia who do not experience falls.

In conclusion, the prevalence of sarcopenia using the EWGSOP-suggested algorithm for sarcopenia in men and women was 21.8% and 22.1%, respectively, and the prevalence of sarcopenia increased age dependently in those older than 75 years in both genders. The prevalence of sarcopenia in men and women showed an opposite trend in the young old and in the old old (those older than 85 years). In addition, participants with sarcopenia had an increased risk for falls and a greater fear of falling. Outcome studies are needed to determine the diagnosis of sarcopenia and the cutoff values for walking speed, HGS, and muscle mass.

Table 2
Characteristics and Physical Performance in Study Participants With or Without Sarcopenia by Gender

	Men					Women				
	Sarcopenia		Nonsarcopenia			Sarcopenia		Nonsarcopenia		
	n = 124		n = 444			n = 290		n = 1024		
	Mean	SD	Mean	SD	*P* value	Mean	SD	Mean	SD	*P* value
Demographic										
Age	81.1	4.8	74.0	4.8	<.001	77.6	5.4	73.9	5.3	<.001
Body mass index	22.2	2.7	23.4	3.0	<.001	22.3	3.3	23.0	3.2	.002
Skeletal muscle mass index	5.53	0.73	7.16	1.01	<.001	4.23	0.46	5.65	0.94	<.001
Fall related										
Fall incidents, n (%)	48 (38.7)		74 (16.7)		<.001	94 (32.4)		254 (24.8)		.006
Fear of falling, n (%)	84 (67.7)		112 (25.2)		<.001	244 (84.1)		512 (50.0)		<.001
Physical performance										
10-m walking time, s	10.0	3.3	7.7	1.8	<.001	10.0	3.1	7.8	2.0	<.001
Timed up and go test, s	10.2	3.5	6.6	1.9	<.001	9.1	3.0	7.1	1.8	<.001
Functional reach, cm	23.4	6.6	29.8	6.2	<.001	23.9	7.2	26.7	5.8	.011
One leg stand, s	9.5	9.2	20.2	18.3	<.001	12.8	17.5	19.9	15.1	<.001
Five chair stand, s	9.3	1.7	8.2	2.0	.004	9.0	2.1	8.2	2.6	.032
Handgrip strength, kg	23.0	5.4	34.0	5.7	<.001	15.9	2.7	22.9	4.6	<.001

Acknowledgments

The authors acknowledge Ms Yoko Moriguchi and Mr Takahiro Mitani for their contribution to the data collection.

References

1. Rosenberg I. Summary comments. Am J Clin Nutr 1989;50:1231–1233.
2. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. European Working Group on Sarcopenia in Older People. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010;39:412–423.
3. Morley JE. Sarcopenia in the elderly. Fam Pract 2012;29:i44–i48.
4. Wang C, Bai L. Sarcopenia in the elderly: Basic and clinical issues. Geriatr Gerontol Int 2012;12:388–396.
5. Cawthon PM, Marshall LM, Michael Y, et al. Frailty in older men: Prevalence, progression, and relationship with mortality. J Am Geriatr Soc 2007;55:1216–1223.
6. Rolland Y, Czerwinski S, Abellan Van Kan G, et al. Sarcopenia: Its assessment, etiology, pathogenesis, consequences and future perspectives. J Nutr Health Aging 2008;12:433–450.
7. Topinkova E. Aging, disability and frailty. Ann Nutr Metab 2008;52:6–11.
8. Schaap LA, Pluijm SM, Deeg DJ, et al. Higher inflammatory marker levels in older persons: Associations with 5-year change in muscle mass and muscle strength. J Gerontol A Biol Sci Med Sci 2009;64:1183–1189.
9. Sattler FR, Castaneda-Sceppa C, Binder EF, et al. Testosterone and growth hormone improve body composition and muscle performance in older men. J Clin Endocrinol Metab 2009;94:1991–2001.
10. Thomas DR. Loss of skeletal muscle mass in aging: Examining the relationship of starvation, sarcopenia and cachexia. Clin Nutr 2007;26:389–399.
11. Hida T, Ishiguro N, Shimokata H, et al. High prevalence of sarcopenia and reduced leg muscle mass in Japanese patients immediately after a hip fracture. Geriatr Gerontol Int 2013;13:413–420.
12. Gibson AL, Holmes JC, Desautels RL, et al. Ability of new octapolar bioimpedance spectroscopy analyzers to predict 4-component-model percentage body fat in Hispanic, black, and white adults. Am J Clin Nutr 2008;87:332–338.
13. Janssen I, Baumgartner RN, Ross R, et al. Skeletal muscle cutpoints associated with elevated physical disability risk in older men and women. Am J Epidemiol 2004;159:413–421.
14. Janssen I. Influence of sarcopenia on the development of physical disability: The Cardiovascular Health Study. J Am Geriatr Soc 2006;54:56–62.
15. Rolland Y, Lauwers-Cances V, Cristini C, et al. Difficulties with physical function associated with obesity, sarcopenia, and sarcopenic-obesity in community-dwelling elderly women: The EPIDOS (EPIDemiologie de l'OSteoporose). Study. Am J Clin Nutr 2009;89:1895–1900.
16. Lopopolo RB, Greco M, Sullivan D, et al. Effect of therapeutic exercise on gait speed in community-welling elderly people: A meta-analysis. Phys Ther 2006; 86:520–540.
17. Roberts HC, Denison HJ, Martin HJ, et al. A review of the measurement of grip strength in clinical and epidemiological studies: Towards a standardised approach. Age Ageing 2011;40:423–429.
18. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med 1998;319:1701–1707.
19. Kim SH, Kim TH, Hwang HJ. The relationship of physical activity (PA) and walking with sarcopenia in Korean males aged 60 years and older using the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV–2, 3), 2008–2009. Arch Gerontol Geriatr 2013;56:472–477.
20. Rolland Y, Lauwers-Cances V, Cournot M, et al. Sarcopenia, calf circumference, and physical function of elderly women: A cross-sectional study. J Am Geriatr Soc 2003;51:1120–1124.
21. Lauretani F, Russo CR, Bandinelli S, et al. Age-associated changes in skeletal muscles and their effect on mobility: An operational diagnosis of sarcopenia. J Appl Physiol 2003;95:1851–1860.
22. Janssen I, Heymsfield SB, Ross R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. J Am Geriatr Soc 2002;50:889–896.
23. Baumgartner RN, Koehler KM, Gallagher D, et al. Epidemiology of sarcopenia among the elderly in New Mexico. Am J Epidemiol 1998;147:755–763.
24. Bouchard DR, Dionne IJ, Brochu M. Sarcopenic/obesity and physical capacity in older men and women: Data from the Nutrition as a Determinant of Successful Aging (NuAge)—the Quebec Longitudinal Study. Obesity (Silver Spring) 2009; 17:2082–2088.
25. Woods JL, Iuliano–Burns S, King SJ, et al. Poor physical function in elderly women in low-level aged care is related to muscle strength rather than to measures of sarcopenia. Clin Interv Aging 2011;6:67–76.
26. Cheng Q, Zhu X, Zhang X, et al. A cross-sectional study of loss of muscle mass corresponding to sarcopenia in healthy Chinese men and women: Reference values, prevalence, and association with bone mass. J Bone Miner Metab; 2013 [Epub ahead of print].
27. Lau EM, Lynn HS, Woo JW, et al. Prevalence of and risk factors for sarcopenia in elderly Chinese men and women. J Gerontol A Biol Sci Med Sci 2005;60: 213–216.
28. Sanada K, Miyachi M, Tanimoto M, et al. A cross-sectional study of sarcopenia in Japanese men and women: Reference values and association with cardiovascular risk factors. Eur J Appl Physiol 2010;110:57–65.
29. Lin CC, Lin WY, Meng NH, et al. Sarcopenia prevalence and associated factors in an elderly Taiwanese metropolitan population. J Am Geriatr Soc 2013;61: 459–462.
30. Pongchaiyakul C, Limpawattana P, Kotruchin P, et al. Prevalence of sarcopenia and associated factors among Thai population. J Bone Miner Metab 2013;31: 346–350.
31. Lee WJ, Liu LK, Peng LN, et al, ILAS Research Group. Comparisons of sarcopenia defined by IWGS and EWGSOP criteria among older people: Results from the I-Lan Longitudinal Aging Study. J Am Med Dir Assoc 2013;14:528. e1–528.e7.
32. Ryu M, Jo J, Lee Y, et al. Association of physical activity with sarcopenia and sarcopenic obesity in community-dwelling older adults: The Fourth Korea National Health and Nutrition Examination Survey. Age Ageing; 2013 [Epub ahead of print].
33. Albani D, Batelli S, Polito L, et al. A polymorphic variant of the insulin-like growth factor 1 (IGF-1) receptor correlates with male longevity in the Italian population: A genetic study and evaluation of circulating IGF-1 from the "Treviso Longeva (TRELONG)" study. BMC Geriatr 2009;9:19.
34. Landi F, Liperoti R, Russo A, et al. Sarcopenia as a risk factor for falls in elderly individuals: Results from the ilSIRENTE study. Clin Nutr 2012;31:652–658.
35. Gillespie SM, Friedman SM. Fear of falling in new long-term care enrollees. J Am Med Dir Assoc 2007;8:307–313.
36. American Geriatrics Society. British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the prevention of falls in older persons. J Am Geriatr Soc 2001;49:664–672.
37. Janssen I, Shepard DS, Katzmarzyk PT, et al. The healthcare costs of sarcopenia in the United States. J Am Geriatr Soc 2004;52:80–85.
38. Landi F, Cruz-Jentoft AJ, Liperoti R, et al. Sarcopenia and mortality risk in frail older persons aged 80 years and older: Results from ilSIRENTE study. Age Ageing 2013;42:203–209.

Geriatrics Gerontology Medline Indexed

Geriatr Gerontol Int 2013

ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Validation and translation of the Kihon Checklist (frailty index) into Brazilian Portuguese

Priscila Yukari Sewo Sampaio, Ricardo Aurélio Carvalho Sampaio, Minoru Yamada, Mihoko Ogita and Hidenori Arai

Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan

Aim: To translate the Japanese Kihon Checklist (frailty index) into the Portuguese language, and to validate the use of the checklist for the assessment of the elderly Brazilian population.

Methods: A semantic analysis was carried out, along with pretesting of bilingual participants. The checklist was validated against the Edmonton Frail Scale.

Results: A total of 188 Brazilian older adults (mean age 69.5 ± 7.47 years) participated in the present study. In the semantic analysis, six elderly participants reported no difficulty with responding to the Portuguese version of the Kihon Checklist. During pretesting with 21 bilingual participants, we found a strong correlation between the total scores of the original version of the Kihon Checklist in Japanese and the translated version in Portuguese ($r = 0.764$, $P < 0.001$). According to the validation process, which involved 161 participants, there was a significant correlation between the total scores of the Kihon Checklist and the Edmonton Frail Scale ($r = 0.535$, $P < 0.001$), and between each domain of the checklist with the total score of Edmonton Frail Scale (lifestyle $\tau = 0.429$, $P < 0.001$; physical strength $\tau = 0.367$, $P < 0.001$; nutrition $\tau = 0.211$, $P = 0.002$; eating $\tau = 0.213$, $P = 0.001$; socialization $\tau = 0.269$, $P < 0.001$; memory $\tau = 0.285$, $P < 0.001$; and mood $\tau = 0.359$, $P < 0.001$). Furthermore, the Portuguese version of the Kihon Checklist showed satisfactory internal consistency (Cronbach's α coefficient: 0.787).

Conclusions: The Portuguese language version of the Kihon Checklist presented good internal consistency and validity. Therefore, we encourage its application in the elderly Brazilian population with an aim of monitoring their frailty to prevent or delay the loss of functional dependence and any other adverse health outcomes. **Geriatr Gerontol Int 2013; ••: ••–••.**

Keywords: community-dwelling older people, Edmonton Frail Scale, frailty, Kihon Checklist, validation.

Introduction

The rapid increase in the number of frail older adults is considered a major healthcare challenge.[1,2] In recent years, the term "frailty" has been repeatedly discussed in the research literature, and several definitions have been proposed.[3] However, there is insufficient evidence to accept a single definition of frailty, and no single definition is currently considered to be a gold standard.[4] In general, there are two predominant approaches to defining frailty: (i) frailty is treated as a count of health impairments;[5,6] and (ii) the frailty phenotype is identified to detect people who find themselves between the independent and the dependent life stages.[7]

Independent of the adopted approach, valid and low-cost frailty assessment tools are required for both research and clinical purposes.[8] Therefore, the Japanese Ministry of Health, Labor and Welfare proposed a frailty index named the "Kihon Checklist" (KCL) that identifies vulnerable older adults as those with a higher risk of becoming dependent.[9,10] The KCL is used for screening frail older adults and is based on the needs of the Japanese long-term care insurance system.[11] The KCL has 25 yes/no questions divided into domains: lifestyle, physical strength, nutrition, eating, socialization, memory and mood (Table 1). A subject is identified as showing frailty if they score 10 points or more in the lifestyle domain. In addition, the results of the KCL can be analyzed separately by each domain. Scoring three

Accepted for publication 8 July 2013.

Correspondence: Professor Hidenori Arai MD PhD, Department of Human Health Sciences, Kyoto University Graduate School of Medicine, 53 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606–8507, Japan. Email: harai@kuhp.kyoto-u.ac.jp

Table 1 Kihon Checklist

1	Do you use public transport (bus or train) to go out by yourself?	0.Yes	1.No
2	Do you shop for daily necessities?	0.Yes	1.No
3	Do you manage financial matters such as savings or deposits by yourself?	0.Yes	1.No
4	Do you visit the homes of friends?	0.Yes	1.No
5	Do you give advice to friends or family members?	0.Yes	1.No
Physical strength			
6	Are you able to go up stairs without using handrails or the wall for support?	0.Yes	1.No
7	Are you able to stand up from a sitting position without support?	0.Yes	1.No
8	Are you able to walk continuously for 15 minutes?	0.Yes	1.No
9	Have you experienced a fall in the past year?	1.Yes	0.No
10	Do you feel anxious about falling when you walk?	1.Yes	0.No
Nutrition			
11	Has your weight declined by 2–3 kg in the past 6 months without dieting?	1.Yes	0.No
12	Height:____ m Weight:____ kg †BMI less than 18.5?	1.Yes	0.No
Eating			
13	Have you experienced more difficulty chewing tough foods than you did 6 months ago?	1.Yes	0.No
14	Do you ever experience choking or coughing when drinking soup or tea?	1.Yes	0.No
15	Do you feel uncomfortable feelings of thirst or dry mouth?	1.Yes	0.No
Socialization			
16	Do you go out at least once a week?	0.Yes	1.No
17	Do you go out less often than you did last year?	1.Yes	0.No
Memory			
18	Do others point out your forgetfulness or tell you "you always ask the same thing"?	1.Yes	0.No
19	When you want to make a call, do you usually search for the telephone number and call on your own?	0.Yes	1.No
20	Do you sometimes not know what the date is?	1.Yes	0.No
Mood			
21	(in the past 2 weeks) You feel no sense of fulfilment in your life.	1.Yes	0.No
22	(in the past 2 weeks) You cannot enjoy things that you enjoyed before.	1.Yes	0.No
23	(in the past 2 weeks) You feel reluctant to do things that you could do easily before.	1.Yes	0.No
24	(in the past 2 weeks) You do not feel that you are a useful person.	1.Yes	0.No
25	(in the past 2 weeks) You feel exhausted for no apparent reason.	1.Yes	0.No
Lifestyle comprises questions 1–20.			

†If body mass index (BMI; weight / height^2) < 18.5, the respondent scores: yes/1 point.

points or more indicates low physical strength in the respective domain, and scoring two points indicates low nutritional status in the respective domain. Scoring two points or more in the eating domain suggests low oral function. A negative answer on question number 16 indicates "house-boundedness", one point or more in the memory domain suggests low cognitive function, and finally, scoring two points or more in the mood domain indicates depression risk.[12,13]

The KCL has been used in several Japanese studies. Ogawa *et al.* concluded that the KCL showed a good concurrent validity against the Fried's criteria for evaluating frailty.[14] The KCL in that study had a sensitivity of 60% and a specificity of 86.4%. Fukutomi *et al.* showed that the risk groups in all categories in the KCL were associated with lower activities of daily living, lower subjective quality of life scores and higher scores on the geriatric depression scale.[12] Another study used the

KCL as an important assessment tool for investigating the cost-effectiveness of a community-based exercise program that reduced and prevented the necessity for care and disability in frail Japanese older adults.[15] Considering the contributions of the KCL to the research, clinical and policy-making spheres, it is an important and versatile measurement that should be extended to countries such as Brazil, which is lacking in frailty assessment tools, that can be easily applied to the aged population and that can be applied to communities where the number of elderly (in Brazil, determined by the chronological age of 60 years or older) is rapidly increasing as other developing countries. Between 1999 and 2009, the number of the country's residents who are aged at least 60 years grew from 9.0% to 11.4%, reaching 21 million inhabitants, according to the Brazilian Institute of Geography and Statistics;[16] and this number is expected to rise to 29.8% of Brazil's total population by the year 2050.[17] Therefore, our purpose was to develop the KCL for use with elderly Brazilian adults by translating a version into Brazilian Portuguese and adapting it to the Brazilian culture.

Methods

This was an epidemiological observational study.

Participants

The participants were recruited by municipal health units and by a recreational club in Curitiba, Paraná State. The inclusion criteria were living in the community, aged 60 years or older and being able to respond to the questionnaire. The additional inclusion criterion for the pretest of the beta version was being bilingual (Japanese and Brazilian Portuguese speaker); and for the validation of the Kihon Checklist – Brazilian Portuguese version was being able to carry out the physical tests. The participants who did not match these criteria or those who did not want to participate in research procedures voluntarily were excluded from the present study. The southern area of the country was chosen because of the large population of Japanese subjects in the region.

The municipal health units regularly organize meetings to promote health education, physical exercise practice, group activity and other activities, and the units were chosen because of their direct contact with a variety of community-dwelling elderly adults. The second recruitment location was a recreational club that promotes Japanese culture with activities directed at all community members, not exclusively Japanese ones. Considering the number of older adults engaged in the activities offered by the health units and the recreational club, the estimated number of members potentially eligible to participate in this research was 120 subjects from the first recruitment location and 250 subjects from the second location.

The subjects were recruited from April to June 2012; the older adults' members of those institutions received oral and written explanation about the research procedures by the researchers themselves and the leaders of the recreational groups offered by those institutions. Participation in the present study was voluntary, and all participants signed an informed consent form. A total of 218 participants were recruited to participate in this research (99 older adults from the health units and 119 members from the recreational club); however, we excluded 30 subjects (15 in each institution) from the analysis because of age lower than 60 years and poor responses in questionnaires, leaving 188 community-dwelling Brazilian older adults (84 from the health units and 104 from the recreational club; Table 2).

Data collections were carried out in June 2012. The study protocol was approved by the Kyoto University Graduate School of Medicine Ethics Committee (E-1575).

Procedures

In accordance with previous validation studies,[18–20] the procedures of the present study consisted of semantic analysis with six volunteers along with pretesting of 21 bilingual participants (Japanese and Brazilian Portuguese speakers), and the validation procedure involved 161 participants.

Translation of Kihon Checklist original version to Brazilian Portuguese language

The translation of the KCL into Brazilian Portuguese was carried out by two native Brazilians members of this study project. Each researcher prepared a Brazilian Portuguese translation, discussed both versions and then prepared an initial Brazilian Portuguese version of the KCL (KCL-PT). This version was then reviewed by a native Brazilian specialist in the Portuguese language.

Next, the KCL-PT was back translated into Japanese by two Brazilian Japanese language experts who were not previously aware of the KCL-PT. The translators received the initial translated version and translated it back into Japanese. After each translator prepared a version, they discussed their translations and then prepared the final KCL-PT back-translated version that was submitted for analysis by a Japanese committee of specialists.

The committee of specialists aimed to verify if the KCL-PT back translation contained any questions with different meanings compared with the original Japanese-language version of the KCL. When the specialists approved the back-translated version, assured of the content similarity between both versions, the version translated into Brazilian Portuguese was

Table 2 Participant characteristics

Variables		Total $n = 188$ Valid % (n)	Semantic $n = 6$ Valid % (n)	Bilinguals $n = 21$ Valid % (n)	Validation $n = 161$ Valid % (n)
Age	Mean ± SD	69.52 ± 7.47	67 ± 9.91	73.81 ± 8.98	69.05 ± 7.0
Sex	Female	74.5 (140)	100 (6)	71.4 (15)	73.9 (119)
Marital status	Single	4.8 (9)	0	4.8 (1)	5 (8)
	Married	54.0 (101)	16.7 (1)	47.6 (10)	56.3 (90)
	Divorced	7.0 (13)	16.7 (1)	4.8 (1)	6.9 (11)
	Widowed	34.2 (64)	66.7 (4)	42.9 (9)	31.9 (51)
Living situation	Alone	17.6 (33)	33.3 (2)	14.3 (3)	17.4 (28)
	With partner	30.3 (57)	0	23.8 (5)	32.3 (52)
	With child	21.8 (41)	16.7 (1)	23.8 (5)	21.7 (35)
	With partner and child	24.5 (46)	16.7 (1)	28.6 (6)	24.2 (39)
	Other	5.3 (10)	33.3 (2)	9.5 (2)	3.7 (6)
Educational level	Elementary school	42.3 (77)	50 (3)	33.3 (6)	43 (68)
	Junior high school	15.4 (28)	33.3 (2)	16.7 (3)	14.6 (23)
	High school	12.6 (23)	0	22.2 (4)	12 (19)
	University	25.8 (47)	0	16.7 (3)	27.8 (44)
	Other	3.8 (7)	16.7 (1)	11.2 (2)	2.6 (4)
Japanese descent	Yes	51.1 (95)	0	100 (21)	46.5 (74)
Activity	Work	22.9 (40)	66.7 (4)	10 (2)	22.8 (34)
	Volunteer	10.9 (19)	0	20 (4)	10.1 (15)
	Retirement	66.3 (116)	33.3 (2)	70 (14)	67.1 (100)
Medication	Yes	82.4 (155)	100 (6)	71.4 (15)	83.2 (134)
No. medications	Mean ± SD	2.68 ± 2.24	4 ± 1.41	3.4 ± 1.96	3.23 ± 2.07
Frequency of medical consultation (past 6 months)	None	12.5 (23)	0	14.3 (3)	12.7 (20)
	1–2 times	59.8 (110)	40 (2)	76.2 (16)	58.2 (92)
	3–4 times	17.9 (33)	20 (1)	9.5 (2)	19 (30)
	5 times or more	9.8 (18)	40 (2)	0	10.2 (16)
Hospitalization (last year)	Yes	12.4 (23)	16.7 (1)	4.8 (1)	13.2 (21)
Self-rated health	Very good to good	48.1 (90)	16.7 (1)	52.3 (11)	48.8 (78)
	Normal	34.8 (65)	33.3 (2)	33.3 (7)	35 (56)
	Not so good to bad	17.1 (32)	50 (3)	14.3 (3)	16.3 (26)
Life satisfaction	Very satisfied to satisfied	87.7 (165)	66.7 (4)	90.4 (19)	88.2 (142)
	Nor satisfied neither unsatisfied	6.9 (13)	16.7 (1)	4.8 (1)	6.8 (11)
	A bit unsatisfied to unsatisfied	5.3 (10)	16.7 (1)	4.8 (1)	4.9 (8)
BMI	Mean ± SD	26.15 ± 4.55	32.59 ± 5.25	24.24 ± 2.79	26.16 ± 4.5

BMI, body mass index.

designated the KCL-PT alpha version, and the study proceeded to semantic analysis.

Semantic analysis of the Kihon Checklist Brazilian Portuguese alpha version

The study volunteers were asked to answer the KCL-PT alpha version and a feedback report. The report was analyzed to verify if there was any topic in the checklist that was difficult to understand. If there was a topic with such a problem, we modified the checklist and restarted the semantic analysis. When the feedback reports indicated satisfaction with the modified checklist, we designated the modified version as the beta version (Table 3) and submitted it for pretesting with bilingual participants.

Pretest of beta version with bilingual participants (Japanese and Brazilian Portuguese speakers)

The volunteers were asked to answer the two KCL versions (the KCL original version in Japanese and the KCL-PT beta version in Portuguese). When both checklists correlated significantly (see statistical analysis section for further details), we designated the Portuguese version as the KCL-PT and submitted it for validation.

Table 3 Kihon Checklist Brazilian Portuguese beta version

1	Você consegue usar ônibus ou trem sem necessidade de ajuda?	0.Sim	1.Não
2	Você faz compras para o seu dia a dia sem necessidade de ajuda?	0.Sim	1.Não
3	Você administra sua conta/poupança bancária sozinho (a)?	0.Sim	1.Não
4	Você visita à casa de seus amigos?	0.Sim	1.Não
5	Você conversa com seus familiares ou amigos?	0.Sim	1.Não
6	Você sobe escada sem o apoio de corrimão ou parede?	0.Sim	1.Não
7	Você se levanta da cadeira sem usar o braço da mesma como apoio?	0.Sim	1.Não
8	Você caminha mais do que 15 minutos?	0.Sim	1.Não
9	Você sofreu alguma queda (caiu) no último ano?	1.Sim	0.Não
10	Você sente medo de cair?	1.Sim	0.Não
11	Nos últimos 6 meses, você emagreceu 2 a 3 quilos (sem estar de dieta)?	1.Sim	0.Não
12	Qual a sua altura?_____m Qual o seu peso? _____kg †IMC menor que 18.5?	1.Sim	0.Não
13	É correto afirmar que "você não consegue comer alimentos de consistência dura tão bem como 6 meses atrás"?	1.Sim	0.Não
14	Você se engasga quando toma chá ou sopa?	1.Sim	0.Não
15	Você se sente desconfortável com a sensação de boca seca?	1.Sim	0.Não
16	Você sai de casa mais do que uma vez por semana?	0.Sim	1.Não
17	Em comparação ao último ano, você tem saído menos de casa?	1.Sim	0.Não
18	As pessoas tem chamado sua atenção quanto ao seu esquecimento, como: "você faz as mesmas perguntas o tempo todo"?	1.Sim	0.Não
19	Você faz ligações telefônicas checando você mesmo o número de telefone?	0.Sim	1.Não
20	É correto afirmar que "às vezes, você não sabe que dia ou mês é hoje"?	1.Sim	0.Não
21	Nas últimas 2 semanas, você está insatisfeito com sua vida diária?	1.Sim	0.Não
22	Nas últimas 2 semanas, você acha sem graça as atividade com as quais você se divertia antes?	1.Sim	0.Não
23	Nas últimas 2 semanas, você sente dificuldade ao fazer coisas que antes achava fácil de fazer?	1.Sim	0.Não
24	Nas últimas 2 semanas, você sente que não é mais útil para os outros?	1.Sim	0.Não
25	Nas últimas 2 semanas, você se sente exausto sem razão?	1.Sim	0.Não

†Se Índice de Massa Corporal (=peso / altura^2) < 18.5, o respondente assinala: sim/1 ponto.

Validation of the Kihon Checklist Brazilian Portuguese version

The participants were asked to carry out two assessments that measure frailty, the KCL-PT and the Edmonton Frail Scale (EFS), which was chosen because it has already been translated to Portuguese, adapted to Brazilian culture and successfully validated in Brazil.[18] In addition, the EFS was chosen because it has potential as a practical and clinical measure of frailty with good construct validity, good reliability, and acceptable internal consistency.[21] The EFS addresses cognition, balance and mobility, mood, functional independence, medication use, social support, nutrition, healthy attitudes, continence, burden of medical illness, and quality of life. Higher levels of frailty on the EFS are represented by higher scores, with a maximum possible score of 17 points.[18]

Statistical analysis

The Kolmogorov–Smirnov test was used to verify the normality of the data. Descriptive analysis was used to verify the feedback reports during the semantic analysis. We used Spearman's correlation analysis to investigate the correlation between the total scores of the original Japanese version of the KCL and the KCL-PT during pretesting with bilingual participants, and to verify the correlation between the KCL-PT and the EFS during the validation process. In addition, we used Kendall's Tau to verify the correlation between each KCL-PT domain with the total score of the EFS. The bivariate comparisons of the EFS total score between the KCL-PT frail participants and non-frail participants were analyzed with the Mann–Whitney *U*-test. Multiple regression analysis was used to verify the contributions of the KCL-PT to the EFS. Finally, we calculated a Cronbach's α coefficient to verify the internal consistency of the KCL-PT. All analyses were carried out using the Statistical Package for the Social Science (SPSS; IBM, Chicago, IL, USA), version 20.0.

Results

Translation process

After the analysis by the Japanese specialists, it was suggested that we modify question number 14 of the

back-translated KCL-PT version. The newly generated version was submitted for a second analysis and was subsequently approved.

Semantic analysis

In the semantic analysis, a total of six community-dwelling Brazilian older women (mean age 67.0 ± 9.91 years) answered the KCL-PT alpha version and the feedback report. The majority of participants (66.7%) required approximately 10–15 min to respond to the KCL-PT alpha version, and the language used in the checklist was considered to be very easy or easy to understand, according to their reports. In addition, the participants reported that the checklist contained no questions that were difficult to answer or uncomfortable. All participants reported that the checklist included their main questions regarding frailty.

Bilingual participants

A total of 21 participants (mean age 73.8 ± 8.98 years) answered both versions of the KCL. The median scores of the original Japanese KCL was 2 points (minimum 0 to maximum 9), and the median scores of the KCL-PT beta version in Brazilian Portuguese language was also 2 points (minimum 0 to maximum 6). There was a strong correlation between the total mean scores of both versions ($r = 0.764$, $P < 0.001$).

Validation process

A total of 161 participants (mean age 69.1 ± 7.0 years) answered the KCL-PT and the EFS. The median score of the KCL-PT was 3.5 points (considered to represent non-frailty according to the reference score, min 0–max 13), and the median score of the EFS was 3 points (considered to represent non-frailty according to the reference score, minimum 0 to maximum 10). Furthermore, the total scores of the KCL-PT and EFS presented a significant correlation ($r = 0.535$, $P < 0.001$) when analyzed with Spearman's correlational analysis and scatter plot (Fig. 1).

The KCL-PT (25 items) showed a satisfactory internal consistency (Cronbach's α coefficient: 0.787). The median score for the various domains was as follows: lifestyle, 3 points (minimum 0 to maximum 13); physical strength, 1 point (minimum 0 to maximum 5); nutrition, 0 points (minimum 0 to maximum 1); eating, 1 point (minimum 0 to maximum 3); socialization, 0 points (minimum 0 to maximum 2); memory, 1 point (minimum 0 to maximum 3); and mood, 0 points (minimum 0 to maximum 5).

Furthermore, all the domains of the KCL-PT correlated with the total score of EFS. The KCL-PT score explained approximately 39% of the EFS score

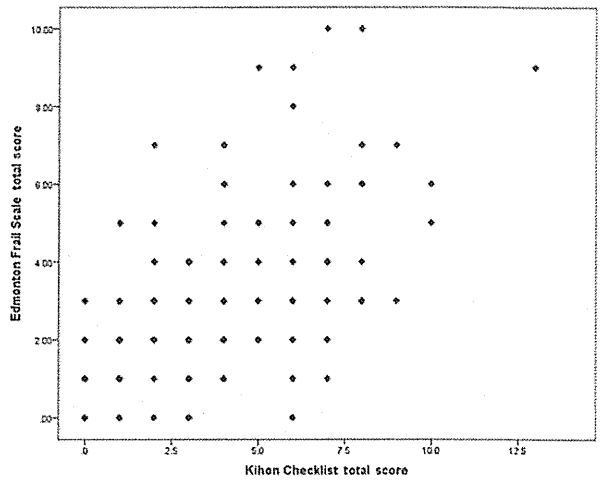

Figure 1 Correlation between the total scores of the Kihon Checklist and the Edmonton Frail Scale.

($R^2 = 0.387$, $P < 0.001$). The domain with the highest influence on the EFS score was physical strength (coefficient β = 0.330, $P = 0.03$), followed by mood (coefficient β = 0.196, $P = 0.01$; Table 4).

The participants were divided into non-frail and frail groups according to the KCL-PT frailty score cut-off points, and we verified that the EFS total score differed significantly between the groups. The KCL-PT frail group was also frailer than the non-frail group according to the EFS, as they presented higher total scores (Table 5).

Discussion

The results of the translation and validation of the KCL-PT procedures were satisfactory. The total score of the Brazilian Portuguese language beta version strongly correlated with the original version of the KCL ($r = 0.764$, $P < 0.001$), as we observed in the results of the pretesting with bilingual participants. In the validation procedure, the total scores of the KCL-PT and the EFS were moderately correlated ($r = 0.535$, $P < 0.001$), and all domain scores of the KCL-PT were correlated with the EFS total score. Furthermore, there was a difference in EFS total scores between the participants who were considered frail and those who were considered non-frail according to the KCL-PT.

The KCL-PT domain with the highest influence on the EFS total score was physical strength (coefficient β = 0.330, $P = 0.03$). Several studies consider that physical function is a particularly important aspect when determining frailty, and have reported that a decline of muscle mass, mobility and balance is associated with becoming frail.[22–24] Therefore, it is valuable to focus on physical function to prevent disabilities in carrying out

Table 4 Relationship between the Kihon Checklist Brazilian Portuguese version and the Edmonton Frail Scale score ($n = 161$)

Edmonton Frail Scale total score				
Kihon Checklist Domain Factors	Kendall's τ Coefficient	*P* value	Regression coefficient β $R^2 = 0.387$	*P*-value <0.001
Lifestyle	0.429	<0.001	0.073	0.788
Physical strength	0.367	<0.001	0.330	0.031
Nutrition	0.211	0.002	0.090	0.267
Eating	0.213	0.001	−0.005	0.966
Socialization	0.269	<0.001	0.075	0.433
Memory	0.285	<0.001	0.145	0.167
Mood	0.359	<0.001	0.196	0.014

Table 5 Differences of the Edmonton Frail Scale total score according to the frailty condition by Kihon Checklist cut-off points ($n = 161$)

Kihon Checklist Domains	Edmonton Frail Scale total score Non-frail Median (min–max), *n*	Frail Median (min–max), *n*	*P*-value
Lifestyle	3 (0–10), 157	6 (5–9), 4	0.015
Physical strength	2 (0–10), 138	4 (2–10), 23	<0.001
Nutrition	3 (0–10), 161	–	–
Eating	2 (0–10), 121	3 (0–10), 40	0.012
Socialization	3 (0–10), 113	5 (3–9), 48	0.002
Memory	2 (0–9), 77	3 (0–10), 84	<0.001
Mood	2 (0–9), 138	4 (1–10), 23	<0.001

Analyzed using Mann–Whitney *U*-test.

activities of daily living and also in instrumental activities of daily living, which is one of the principal factors for institutionalization and is also associated with mortality among older adults.[25,26] However, frailty is not unidimensional; the focus must be extended to include aspects such as cognition, mood and social support.[21] In the present study, we verified the contribution of the mood domain score of the KCL-PT to EFS total score (coefficient β = 0.196; $P = 0.01$). Evidence suggests that depression in the aged population is also associated with functional impairment and increased mortality.[27,28]

The EFS does not directly address the lifestyle, eating or socialization domains that are addressed by the KCL-PT. Those differences might explain the low regression coefficients of these domains with the EFS total score. It was intriguing that the nutrition and memory domains of the KCL-PT, which have corresponding domains in the EFS, did not present a significant regression coefficient for the EFS total score. However, when we analyzed just the specific domains, and not the total EFS total score, we verified a significant correlation between those domains (nutrition domain Kendall's τ coefficient = 0.483, $P < 0.001$ and memory domain, Kendall's τ coefficient =0.221, $P = 0.002$).

Although the KCL-PT domains presented a significant regression coefficient with EFS, the value could be considered low ($R^2 = 0.387$, $P < 0.001$). The EFS domains, such as general health state, social support, medication use and continence, that were not directly investigated by the KCL-PT could represent the remaining coefficient value that is unexplained by KCL-PT. Despite these differences, the essences of both frailty assessments were deemed similar because their total scores were significantly correlated, suggesting that the EFS was a suitable assessment of frailty for use in validating the Kihon Checklist in Brazil.

Although this is a pioneer study using the KCL in Brazil, we unfortunately could not compare our results with other Brazilian studies present in the literature. Despite this limitation, we believe that the quality of the KCL-PT was satisfactory in terms of internal consistency (Cronbach's α coefficient = 0.787), and the

KCL-PT is considered a valid frailty index for use with elderly Brazilian adults because its results correlated with those of the already-validated EFS. Therefore, we suggest the use of the KCL-PT to screen and monitor the elderly Brazilian population's frailty conditions.

Even though frailty confers morbidity, mortality and healthcare costs,[1,7] causing an increased strain on all healthcare systems and family structures, this type of syndrome can be avoided or delayed with identification and early intervention.[1] The awareness of this syndrome and its risks can be useful in supporting the care of frail elderly patients by healthcare workers, and thus can decrease patients' risks for adverse health outcomes.[29] Therefore, the ability to measure frailty is critical for this process at a healthcare policy level, as well as clinically, and information about frailty can support program planners by identifying the range of services that might be required, and the anticipated level of need for those services. Clinically, frailty stratification can help in planning interventions or predicting a patient's risk of death or need for institutional care.[30] The KCL-PT can be used to answer this emergent and emergency demand in screening the frailty of the elderly Brazilian population as a first step in facing and confronting frailty in this population.

The present study had several limitations, including the limited sample size and possible bias as a result of the choice of recruitment location. We suggest future studies that recruit a larger sample size, include different regions of Brazil and different institutional settings, such as communities for the elderly (urban and rural areas), nursing homes and other settings. Furthermore, additional studies to verify the association of the KCL-PT with other measures of health are necessary.

We successfully translated the KCL into Brazilian Portuguese and validated the instrument's application in an elderly Brazilian population. We encourage the application of the KCL-PT to investigate frailty in older adults with an aim of preventing or delaying functional dependence and other adverse health outcomes caused by the aging process. Given the simple 25 yes/no question structure of the KCL-PT, the checklist is suitable for clinical application, research and the needs of policy makers.

Acknowledgments

We thank Kaoru Tanaka de Lira, Ruchia Uchigasaki and Eulália Teixeira de Vasconcelos for their contributions to the translation and back-translation procedures; and Hutoshi Sewo and Tsuyako Kobayashi Sewo for their great effort in recruiting participants for the pretest of the beta version with bilingual participants. We thank Jorge Ishii, Helena Ishii, Alberto Daikiti Sewo, Lúcia Kayoko Mitsuhashi Sewo and their team for authorizing us to carry out the research in the Nikkei Club, and for their great contributions to the data collection. In addition, we thank Danielle Inês da Silva Sewo and Graziela Ghazal, and their collaborators for supporting us in carrying out data collection in the health units. Finally, we sincerely thank all the volunteers who contributed to our study.

This study was supported by Grants-in-Aid for Comprehensive Research on Aging and Health from the Ministry of Health, Labor, and Welfare of Japan.

Disclosure statement

The authors declare no conflict of interest.

References

1 Markle-Reid M, Browne G. Conceptualizations of frailty in relation to older adults. *J Adv Nurs* 2003; **44** (1): 58–68.
2 Slaets JP. Vulnerability in the elderly: frailty. *Med Clin North Am* 2006; **90**: 593–601.
3 Hogan DB, MacKnight C, Bergman H. Models, definitions, and criteria of frailty. *Aging Clin Exp Res* 2003; **15** (3): 1–29.
4 Hamerman D. Toward an understanding of frailty. *Ann Intern Med* 1999; **130**: 945–950.
5 Rockwood K, Mitnitski A, MacKnight C. Some mathematical models of frailty and their clinical implications. *Rev Clin Gerontol* 2002; **12**: 109–117.
6 Mitnitski A, Song X, Skoog I *et al.* Relative fitness and frailty of elderly men and women in developed countries and their relationship with mortality. *J Am Geriatr Soc* 2005; **53**: 2184–2189.
7 Fried LP, Tangen CM, Walston J *et al.* Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001; **56**: 146–156.
8 Puts MT, Lips P, Deeg DJ. Static and dynamic measures of frailty predicted decline in performance based and self-reported physical functioning. *J Clin Epidemiol* 2005; **58**: 1188–1198.
9 Nemoto M, Yabushita N, Kim M, Matsuo T, Seino S, Tanaka K. Assessment of vulnerable older adult's physical function according to the Japanese Long-Term Care Insurance (LTCI) system and Fried's criteria for frailty syndrome. *Arch Gerontol Geriatr* 2012; **55**: 385–391.
10 Japanese Ministry of Health, Labour and Welfare. The Manuals of the Evaluation for Ability to Perform Daily Activities on Preventive Care. Japan Ministry of Health, Labour and Welfare. 2005 [Cited 9 Feb 2013.] Available from URL: http://www.mhlw.go.jp/topics/2009/05/dl/tp0501-1c_0001.pdf
11 Tomata Y, Hozawa A, Ohmori-Matsuda K *et al.* Validation of the Kihon Checklist for predicting the risk of 1-year incident long-term care insurance certification: the Ohsaki Cohort 2006 Study. *Nippon Koshu Eisei Zasshi* 2011; **58**: 3–13.
12 Fukutomi E, Okumiya K, Wada T *et al.* Importance of cognitive assessment as part of the "Kihon Checklist" developed by the Japanese Ministry of Health, Labour and Welfare for prediction of frailty at a 2-year follow up. *Geriatr Gerontol Int* 2013; **13**: 654–662.

13 Japanese Ministry of Health, Labour and Welfare. The latest information about Long Term Care Insurance, Vol 158. 2010 [Cited 9 Feb 2013.] Available from URL: http://jamcf.jp/institution/2010/kaigohokeninfo158.pdf
14 Ogawa K, Fujiwara Y, Yoshida H *et al.* The validity of the "Kihon Check-list" as an index of frailty and its biomarkers and inflammatory markers in elderly people. *Nihon Ronen Igakkai Zasshi* 2011; **48**: 545–552.
15 Yamada M, Arai H, Sonoda T, Aoyama T. Community-based exercise program is cost-effective by preventing care and disability in Japanese frail older adults. *J Am Med Dir Assoc* 2012; **13**: 507–511.
16 Brazilian Institute of Geography and Statistics. National Survey by Household Sampling, Synthesis of Indicators 2009. 2010 [Cited 2 July 2013.] Available from URL: http://www.ibge.gov.br/home/estatistica/populacao/trabalhoerendimento/pnad2009/pnad_sintese_2009.pdf
17 Brazilian Institute of Geography and Statistics. Projeções da população. Projeção da população do Brasil: 1980–2050. 2008 [Cited 9 Feb 2013.] Available from URL: http://www.ibge.gov.br/home/estatistica/populacao/projecao_da_populacao/2008/projecao.pdf
18 Fabrício-Wehbe SCC, Schiaveto FV, Vendrusculo TRP *et al.* Adaptação Cultural e Validade da Edmonton Frail Scale –EFS em uma amostra de Idosos Brasileiros. *Rev Latino-Am Enfermagem* 2009; **17**: 1043–1049.
19 Bertolazi AN, Fagondes SC, Hoff LS *et al.* Validation of the Brazilian Portuguese version of the Pittsburgh Sleep Quality Index. *Sleep Med* 2011; **12**: 70–75.
20 Geisinger KF. Cross-cultural normative assessment: translation and adaptation issues influencing the normative interpretation of assessment instruments. *Psychol Assess* 1994; **6**: 304–312.
21 Rolfson DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. Validity and reliability of the Edmonton Frail Scale. *Age Ageing* 2006; **35**: 526–529.
22 Topinkova E. Aging, disability and frailty. *Ann Nutr Metab* 2008; **52** (1): 6–11.
23 Ferrucci L, Guralnik JM, Studenski S, Fried LP, Cutler Jr GB, Walston JD. Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: a consensus report. *J Am Geriatr Soc* 2004; **52**: 625–634.
24 Singh AS, Chin APMJ, Bosscher RJ, van Mechelen W. Cross-sectional relationship between physical fitness components and functional performance in older persons living in long-term care facilities. *BMC Geriatr* 2006; **6**: 4.
25 Koyano W, Shibata H, Nakazato K, Haga H, Suyama Y, Matsuzaki T. Mortality in relation to instrumental activities of daily living. *J Chronic Dis* 1987; **40**: 481– 489.
26 Scott WK, Macera CA, Cornman CB, Sharpe PA. Functional health status as a predictor of mortality in men and women over 65. *J Clin Epidemiol* 1997; **50**: 291–296.
27 Beekman ATF, Deeg DJH, Braam AW, Smit JH, Van Tilburg W. Consequences of major and minor depression in later life: a study of disability, well-being and service utilization. *Psychol Med* 1997; **27**: 1397–1409.
28 Ryan J, Carriere I, Ritchie K *et al.* Late-life depression and mortality: influence of gender and antidepressant use. *Br J Psychiatry* 2008; **192**: 12–18.
29 Espinoza S, Waltson JD. Frailty in older adults: insights and interventions. *Cleve Clin J Med* 2005; **72**: 1105–1112.
30 Rockwood K, Song X, MacKnight C *et al.* A global clinical measure of fitness and frailty in elderly people. *CMAJ* 2005; **173**: 489–495.

Journal of Clinical Gerontology & Geriatrics xxx (2013) 1–6

Contents lists available at SciVerse ScienceDirect

Journal of Clinical Gerontology & Geriatrics

journal homepage: www.e-jcgg.com

Original article

The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas

Priscila Yukari Sewo Sampaio, OT, MSc [a,*], Emi Ito, OT, PhD [b], Ricardo Aurélio Carvalho Sampaio, PE [a]

[a] Department of Human Health Sciences, Kyoto University, Graduate School of Medicine, Kyoto, Japan
[b] Department of Health Sciences, Nagoya University, Graduate School of Medicine, Nagoya, Japan

ARTICLE INFO

Article history:
Received 4 June 2012
Received in revised form
15 October 2012
Accepted 26 November 2012

Keywords:
Activity
Aged
Participation
Quality of life
Rural health
Urban health

ABSTRACT

Background/Purpose: Quality of life (QOL) is an important health outcome of the aged population, and it is determined by many factors. Evidence shows that the place where older people live is associated with their health and QOL; however, the environmental factors of QOL have not been clearly investigated. Therefore, the purpose of our study was to verify the difference in QOL between Japanese elderly people living in rural and urban areas and the role of activity and participation routine in their QOL.
Methods: Participants were 830 community-dwelling older adults recruited in a municipal college in an urban area (n = 550, age = 68.5 ± 4.3 years) and in a health center in a rural area (n = 280, age = 69.8 ± 7.8 years), both in Japan. QOL was assessed by WHOQOL-BREF and WHOQOL-OLD, both developed by the World Health Organization. The occupational routine was measured by a questionnaire concerning frequency of engagement in several activities. Variables were compared by t test, Chi-square test and the Mann–Whitney U test. Additionally, multiple regression analysis was used to verify the relation between QOL and occupational routine.
Results: Participants living in the urban area had higher QOL scores than those living in the rural area (BREF urban = 3.68 ± 0.42 vs. rural = 3.43 ± 0.40, $p < 0.01$; OLD urban = 3.56 ± 0.42 vs. rural = 3.46 ± 0.41, $p < 0.05$). In WHOQOL-BREF, physical, work, and reading and writing activities were positively related with QOL in the urban group; and physical and art activities in rural participants. In WHOQOL-OLD, no difference was found; however, social activity was important for both groups.
Conclusion: Our findings showed that QOL states and related occupational routine differed between urban and rural areas. Urban participants had better QOL scores than rural ones and (among the activities) physical, work, and reading and writing activities were associated with their QOL. For the rural group, physical and art activities were important. Furthermore, social activity was an important activity for QOL in both populations.

1. Introduction

The aged population is a growing concern around the world. This is especially so in Japan which is considered to be a super-aged society with the highest proportion of elderly people,[1] representing 23.1% of its total population in 2011.[2]

Many studies have explored the health outcomes of the aged population to plan the interventions to be offered and to predict health and social care needs. One of these outcomes is quality of life (QOL), which has been the focus of much attention and numerous surveys.[3–6] Among this research, there is evidence that the place in which one lives is one of the factors that influences the health and QOL of older people. People living in rural areas presented lower QOL scores than those from urban areas; such results may be explained by environmental differences, educational resources, social and health assistances, occupation, and other factors.[5–10] However, contradictory results were also found regarding the relation between living place and QOL, and it was reported that rural or urban environments had a minor influence on QOL among the older population.[11]

Considering the contrasting results found in the literature about QOL in urban and rural residents, combined with the lack of information related to QOL and occupational routine, we designed

* Corresponding author. 53 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan.
E-mail address: sewo.yukari.55n@st.kyoto-u.ac.jp (P.Y. Sewo Sampaio).

2210-8335/$ – see front matter
http://dx.doi.org/10.1016/j.jcgg.2012.11.004

a study to verify the differences of QOL between Japanese older adults living in rural and urban areas, and to analyze the relationship between QOL and occupational routine with an urban–rural perspective.

2. Methods

2.1. Participants

The urban participants were recruited in a municipal college for the elderly and the rural participants in a healthcare center, both in Japan. We recruited in these two areas because of the differences of sociodemographic indexes and base economic activities to properly characterize an urban and a rural area. The population of the urban area was over 2 million citizens in a total area of around 300 km^2 with industrial activity, while the population in the rural area was less than 20,000 inhabitants in a total area of around 900 km^2 with agricultural activity as the source of wealth creation.

The criteria for inclusion were community-dwelling individuals over 60 years old who were able to complete the questionnaires. We included people aged 60 years or older because we aimed to investigate work activity as part of the occupational routine; in most companies in Japan, the retirement process usually starts from the age of 60 years. Older adults who had difficulty in completing the questionnaires and research procedures independently were excluded from this study.

A total of 830 individuals were invited to participate in this research. In the urban area, 550 elderly people were recruited of whom 287 completed the procedures. In the rural area, 280 elderly people were recruited of whom 178 completed the procedures. A total of 465 Japanese older adults were included in the statistical analysis in our study (Table 1).

2.2. Data collection and procedures

We met the institutions' directors in the rural and urban areas, explained the research project and received their permission to conduct the surveys. We then met the older adults in the institutions, explained the study and asked them to participate. The invitation was made orally and in writing. The questionnaires were distributed with the informed consent form attached and the answered questionnaires represented the agreement to participate. Each participant took approximately 30 minutes to fill out the questionnaires, and sent the completed questionnaires to the main researcher by mail. Data were collected from August 2009 to January 2010. This research was approved by the ethics committee at Nagoya University in June 2009 (Protocol number 9-606).

Table 1
Participants' characteristics ($n = 465$).

Variable		Rural % ($n = 178$)	Urban % ($n = 287$)	p
Age (y) (mean ± SD)		69.8 ± 7.8	68.5 ± 4.3	0.03
Gender	Male	44.4	55.6	0.02
Educational level	Elementary school	3.9	0	0.01
	Junior high school	32.0	5.8	
	High school	52.8	53.6	
	Junior college	3.4	6.2	
	University	3.4	28.3	
	Other	4.5	6.2	
Living arrangement	Alone	20.5	19.3	0.47
	Couple	52.3	49.1	
	Three or more	22.2	27.7	
	Other	5.1	3.9	
Presence of medical service	Yes	64.3	63.9	0.93

SD = standard deviation.

2.3. Measurements

2.3.1. Sociodemographic characteristics

A brief questionnaire was used to collect demographic variables regarding gender, age, education level, living arrangement and presence of medical services use. Because of ethical concerns, we could not investigate the economic status of the participants in this study.

2.3.2. Quality of life

QOL was assessed through two questionnaires: WHOQOL-BREF Japanese version[12] and WHOQOL-OLD Japanese preliminary version.[13] Both were developed by the World Health Organization (WHO), which suggests applying both assessments in conjunction when assessing QOL in older adults. WHOQOL-BREF is divided into physical, psychological, social relationship and environment domains. The scores for each item range from 1 (poor) to 5 (good); a higher score means a higher level of QOL. The internal consistency tested by Cronbach α ranges from 0.66 to 0.82. Discriminate validity is 31.2 for physical health; 12.3 for psychological health; 8.4 for social relationships, and 6.6 for environment.[14] In our study, the internal consistency reliability tested by the Cronbach α of the WHOQOL-BREF (26 items) in the urban participants was 0.911 and in the rural participants it was 0.893. The complementary assessment to measure the QOL of older adults was the WHOQOL-OLD divided into six domains: sensory abilities, autonomy, past–present–future activities, social participation, death and dying, and intimacy. The scores are similar to those for the WHOQOL-BREF. The WHOQOL-OLD Japanese preliminary version showed a high validity score, excluding the question of death and dying.[15] The consistency for the final version of the Japanese WHOQOL-OLD instrument has not yet been published; however, we tested its internal consistency reliability by the Cronbach α and found the values of 0.854 in the urban group and 0.832 in the rural one.

2.3.3. Activity and participation

Occupational routine was measured by an original activity and participation questionnaire with 10 questions concerning frequency of engagement in several activities (Table 2). These activities were chosen based on occupational performance areas in the Occupational Therapy Practice Framework focused on occupations and daily life activities,[16] while others were taken from Activity and Participation in International Classification of Functioning, Disability and Health[17] and others were chosen based on a previous study that included engagement in activities.[18]

2.4. Statistical analysis

Participants' characteristics were investigated using descriptive analysis. Aiming to verify the differences of sociodemographic characteristics between urban and rural participants, we performed the t test for continuous variables and the Chi-square test for categorical variables; the significant level was considered to be $p < 0.05$. Regarding occupational routine, the urban–rural differences were analyzed using the Mann–Whitney U test and the relationship between QOL and occupational routine was analyzed independently for each living area by multiple regression analysis via the stepwise model. The stepwise method was chosen to verify which model better fits the relation between all investigated activities and QOL. Moreover, collinearity diagnostics were carried out in the multiple regression analyses.

Please cite this article in press as: Sewo Sampaio, PY, et al., The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas, Journal of Clinical Gerontology & Geriatrics (2013), http://dx.doi.org/10.1016/j.jcgg.2012.11.004

Table 2
Questionnaire for participation in activities.

Activity and Participation Questionnaire				
This questionnaire concerns the frequency of engagement in several activities. Considering the last 2 weeks, please, circle the number that you decide most appropriate.				
Example: Drink green tea (condition: drink green tea 3–4 times in a week)				
Never	Seldom	Quite often	Very often	Always
1 (0 times/week)	2 (1–2 times/week)	③ (3–4 times/week)	4 (5–6 times/week)	5 (7 times/week)
1. **Housework** (washing; cleaning; shop daily; repair house, garden; care for the family; other)				
1	2	3	4	5
2. **Work** (full time job; part time job; informal work; include volunteering)				
1	2	3	4	5
3. **Contact with friends and family who live apart** (meeting; visit; talk by telephone; contact by mail; other)				
1	2	3	4	5
4. **Using transport or driving a car**				
1	2	3	4	5
5. **Social activity** (community event; elderly's club; religious activity; other)				
1	2	3	4	5
6. **Reading and writing** (read a book, a newspaper; write a letter, a poem; other)				
1	2	3	4	5
7. **Physical activity** (walking; gate ball; gymnastics; sports; others)				
1	2	3	4	5
8. **Handicraft** (knitting; sewing; articles made out of paper by hand)				
1	2	3	4	5
9. **Art activity** (appreciate movie; art museum; picture; musical instrument performance; chorus; tea ceremony, flower arrangement, etc.)				
1	2	3	4	5
10. **Watching TV and listening to music**				
1	2	3	4	5

3. Results

3.1. Quality of life

Participants living in the urban area had a higher total mean score for QOL than those in the rural area as indicated by t test analysis (BREF urban = 3.68 ± 0.42 vs. rural = 3.43 ± 0.40, $t = 5.75$, $p < 0.01$; OLD urban = 3.56 ± 0.42 vs. rural = 3.46 ± 0.41, $t = 2.4$, $p < 0.05$).

In WHOQOL-BREF, participants living in the urban area had higher mean scores in the physical ($t = 3.88$, $p < 0.01$), psychological ($t = 4.02$, $p < 0.01$) and environment domains ($t = 8.21$, $p < 0.01$) (Fig. 1).

Moreover, in WHOQOL-OLD, the urban participants also had higher mean scores in the autonomy ($t = 2.72$, $p < 0.01$) and intimacy domains ($t = 2.15$, $p < 0.05$) in comparison with those from the rural area (Fig. 2).

3.2. Activity and participation

Individuals from the urban area had higher participation in reading and writing (U = −3.33, $p < 0.01$), contacts with friends and family that live apart from them (U = −2.87, $p < 0.01$), physical activities (U = −4.17, $p < 0.01$) and art activities (U = −7.38, $p < 0.01$) than those from the rural area. While participants from the rural area were more engaged in work activities (U = −3.43, $p < 0.01$) than their urban counterparts (Table 3).

3.3. Relation between QOL and activity and participation

The important activities among the occupational routine were different between urban and rural individuals as indicated by multiple regression analyses. In WHOQOL-BREF, in the urban group, the best model included work activity, reading and writing,

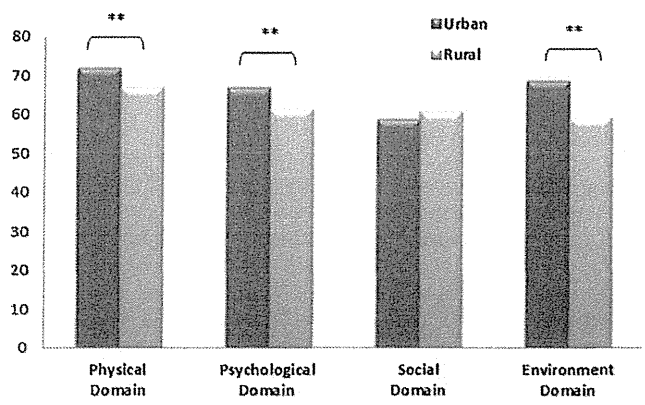

Fig. 1. Difference between scores in WHOQOL-BREF questionnaire domains between urban and rural participants. $^{**}p < 0.001$.

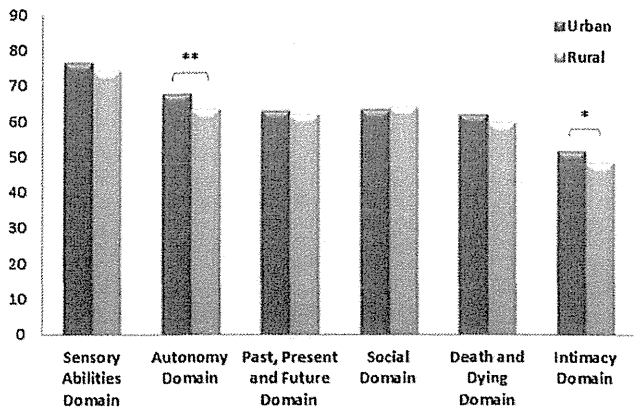

Fig. 2. Difference between scores in WHOQOL-OLD questionnaire domains between urban and rural participants. $^{*}p < 0.05$. $^{**}p < 0.001$.

Please cite this article in press as: Sewo Sampaio, PY, et al., The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas, Journal of Clinical Gerontology & Geriatrics (2013), http://dx.doi.org/10.1016/j.jcgg.2012.11.004

Table 3
Participation in activities according to the living area.

Activity	Rural *n*	Median (interquartile)	Urban *n*	Median (interquartile)	*p*
Reading and writing	162	5 (3–5)	285	5 (4–5)	0.01
Contact with friends and family	163	3 (2–4)	287	4 (3–4)	0.01
Physical activity	161	3 (2–4)	287	4 (3–5)	0.01
Art activity	162	1 (1–3)	287	3 (2–3)	0.01
Work	158	2 (1–4)	285	1 (1–3)	0.01
Watching TV and listening to music	164	5 (4–5)	287	5 (4–5)	NS
Housework	164	5 (3–5)	286	4 (3–5)	NS
Using transport or driving a car	159	4 (2–5)	284	4 (4–5)	NS
Social activity	162	3 (2–3)	285	3 (2–3)	NS
Handicraft	162	1 (1–2)	285	1 (1–2)	NS

NS = not significant.

and physical activity. In the rural group results, these activities were not included; however, in their case, art activity showed a relationship with QOL (Table 4). The collinearity diagnostics results showed that there was no variable with collinearity in the multiple regression analyses in both groups (tolerance coefficients in urban group: work activity = 0.998; physical activity = 0.919; reading and writing = 0.921; tolerance coefficients in rural group: physical activity = 0.98; art activity = 0.98).

In WHOQOL-OLD, differences between individuals from urban and rural areas were not found. The activity included in the best model suggested by a stepwise method was social activity in both populations (Table 4).

4. Discussion

Japan is an industrialized country with one of the largest economies in the world. Its economy is consistent in branches related to international trade developed mainly in urban areas, but the engagement in rural activities such as agriculture is considerably lower. One clear reflection of this inequality is the difference in population density; in 2010 most of the total population was concentrated in urban areas (66.8%) as opposed to rural areas (33.2%).[19] There were further differences, as our findings showed.

In the present research we observed that urban individuals had a better QOL in comparison with those from the rural area in different domains from WHOQOL-BREF and WHOQOL-OLD, a tendency also confirmed by other studies.[5,6] This difference may be explained by socioeconomic status, such as education level and occupational social class, which varies according to the living area. Other studies stated that socioeconomic status was a critical factor predicting the health status of older people and was also related to QOL among Asian elderly people.[20–23] In our study, urban participants showed higher educational levels and industry-based economics, while rural participants showed lower educational levels and were more involved in agricultural activities, as already mentioned. Additionally, we suggest that the better QOL scores of urban participants are because of their higher engagement in activities positively related to their QOL, such as physical activity and reading and writing in comparison with rural participants who showed lower participation in QOL-related activities.

Table 4
Influence of participation in activities on quality of life by living areas.

		WHOQOL- BREF	
Rural		**Urban**	
$R^2 = 0.148$	$p = 0.01$	$R^2 = 0.103$	$p = 0.01$
Factor	**Regression coefficient β**	**Factor**	**Regression coefficient β**
Art activity	0.257	Physical activity	0.184
Physical activity	0.257	Reading and writing	0.174
		Work activity	0.139
		WHOQOL-OLD	
Rural		**Urban**	
$R^2 = 0.072$	$p = 0.01$	$R^2 = 0.055$	$p = 0.01$
Factor	**Regression coefficient β**	**Factor**	**Regression coefficient β**
Social activity	0.269	Social activity	0.235

Even that urban participants had a better QOL, the overall QOL from urban and rural Japanese participants was poor in comparison with other countries, especially the social domain, confirming other studies conducted in Japan.[13,24,25] In a cross-cultural study, Japan had the worst score in the social domain compared to 32 other countries.[26] This low score may be related to the findings that the social activity related positively with QOL, however rural and urban residents showed low engagement in social activity. It is important to mention that social activity related positively to QOL in both groups when assessed by WHOQOL-OLD; but the same was not observed when assessed by WHOQOL-BREF. Therefore, we reinforce the importance of application of both WHOQOL assessments to investigate in depth the QOL demands of older adults.

Regarding the influence of occupational routine in QOL, art activity was important only for the QOL in participants from the rural area. This finding may be explained by few options for leisure time; entertainment options are limited in comparison with urban areas. One study confirmed the urban–rural imbalance in terms of leisure activities and facilities, concluding that in rural areas there is a lack of leisure opportunities while in urban areas the opposite situation is observed with plenty of leisure facilities and opportunities for leisure activity.[7] Despite the fact that art was an activity related only to the QOL of rural residents, reading and writing was significantly important for urban QOL. Such findings may be linked with the higher educational level of urban participants. Additionally, they might have more access to bookstores in their living place, which encourage the habit of reading and writing. Moreover, work activity was also important for QOL in urban participants. It is known that higher qualification is directly related to more and better opportunities of work; moreover, the urban environment presents the possibility to be engaged in pleasurable work because of the presence of a wide spectrum of choices among big companies and industries.[7] Such favorable conditions may increase professional and life satisfaction and positively influence QOL. The same background cannot be extended to the rural area where the majority of work opportunities are related to agricultural labor.

In both groups, physical activity was positively related with QOL. This association is well established as reported by other studies, where significant correlations were found between physical activity and QOL scores.[3,27] Even in the oldest old people, increases in the level of physical fitness suggest better contribution to the improvement of QOL.[28]

Another activity important for QOL in both groups was social activity. As old age can be seen as a period of life in which the older

Please cite this article in press as: Sewo Sampaio, PY, et al., The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas, Journal of Clinical Gerontology & Geriatrics (2013), http://dx.doi.org/10.1016/j.jcgg.2012.11.004

adult is free to explore personal fulfillment, self-realization and leisure, social activity might be a good contributor to achieve these expectations.[29,30] The benefits of social activity include re-establishing and strengthening interpersonal relationships, creating opportunities to give and receive social support, maintaining social roles and self-validating experiences that can enhance feelings of psychological well-being.[31] These findings were compatible with other previous studies that confirmed social participation as an important factor for QOL in the aged population.[32] However, in our study we observed a deficit on its engagement and an impaired QOL in the social domain in both cohorts. Irrespective of their living place, older adults must be encouraged to enjoy the events offered by their local community and they must be stimulated to become an active community member favoring human exchange.

Considering our findings, we suggest that extra attention must be given by those close to older adults in a retirement process irrespective of their living area. The retirement period triggers a new occupational routine in the aging process because of the removal of a busy work routine. Therefore, retirement may provide freedom for the older adult to explore new interests and occupations; or may result in isolation from routine and community, often leading to declining health and QOL.[33] Accordingly, we suggest the introduction of health promoters to adjust to the peculiarities of each living area and provide opportunities for older adults to engage in activities that are important for their QOL; for urban participants, physical, reading and writing, work and social activities; while for rural participants, physical, art and social activities. We reinforce the importance of bringing new challenges to elderly people by exploring these activities as much as possible to enrich their routines and consequently their lives. Once an individual has had first contact with an activity and enjoys it, they can continue it by themselves. However, if older adults resist the offered activity, a suitable strategy may be for a friend, neighbor or family member to participate in the process with them. It is possible to prepare an interesting occupational routine with the mentioned QOL-related activities combined with individual hobbies that provide pleasure and wellbeing for older adults, bringing vital energy to their lives. Thus, as health promoters, we encourage the use of our findings to guide older adults toward improving their lives.

The limitations of this study were the different proportion of participants between urban and rural areas and in gender, age group and educational level. Additionally, we mitigated the relationship between participation in activities and QOL because of the low, however statistically significant, regression coefficients and contribution ratios. Furthermore, future research is needed to explore other factors that may influence the rural and the urban Japanese QOL, such as income, spirituality, social discrimination, self-criticism, regrets, pain, disease, medication etc.[13,15]

In summary, this research achieved its purpose of verifying the difference in QOL between rural and urban Japanese participants and the influence of occupational routine on their QOL. The urban participants had better QOL scores in comparison with rural participants, and the occupational routine correlated with QOL in a different manner according to the living area. For urban participants, the reading and writing, physical, and work activities were related to their QOL, while for rural participants the physical and art activities were important for their QOL as assessed by the WHOQOL-BREF. Social activity was important for QOL in both groups as assessed by the WHOQOL-OLD.

It is known that many efforts have been made through Japanese policies to minimize the urban–rural disparities; however, our findings suggest that improvements are still needed, such as providing universal opportunities for both urban and rural older adult residents. The implications for the practice of our study are to facilitate the planning of a meaningful routine for older adults, being mindful of the peculiarities of each cohort such as the different factors affecting their QOL. For further studies, we recommend more in-depth investigation into the relationship between QOL and occupational routine in different cohorts and other QOL-related variables.

Acknowledgments

We thank all the older adults that participated in our study, and the institutions that allowed us to conduct the data collection in their areas. We are also indebted to Professor Takeshi Hatta in Kansai University of Welfare Sciences, Professor Nobuyuki Hamajima in Nagoya University and Mr Yoshiyuki Kawamoto in the municipal college who coordinated between us and the institutions.

References

1. Statistic Bureau Japan. *Statistical handbook of Japan 2010*. Tokyo, Japan: Statistics Bureau, Ministry of Internal Affairs and Communications; 2010.
2. Statistics Bureau Japan. *Ministry of internal affairs and communications*. Population Estimates. Available at: http://www.stat.go.jp/data/jinsui/pdf/201102.pdf; 2011 [accessed 03.04.11].
3. Yamauchi T, Midorikawa T, Hagihara J, Sasaki K. Quality of life, nutritional status, physical activity, and their interrelationships of elderly living on an underpopulated island in Japan. *Geriatr Gerontol Int* 2007;**7**:26–33.
4. Lau R, Morse CA. Health and wellbeing of older people in Anglo-Australian and Italian-Australian communities: a rural-urban comparison. *Aust J Rural Health* 2008;**16**:5–11.
5. Oguzturk O. Differences in quality of life in rural and urban populations. *Clin Invest Med* 2008;**31**:E346–50.
6. Zhou B, Chen K, Wang J, Wang H, Zhang S, Zheng W. Quality of life related factors in the older rural and urban Chinese populations in Zhejiang province. *J Appl Gerontol* 2011;**30**:199–225.
7. Su B. Leisure life of elderly residents in China: a case study of difference between rural and urban area. *Asian Social Sci* 2008;**4**:100–6.
8. Buys L, Roberto KA, Miller E, Blieszner R. Prevalence and predictors of depressive symptoms among rural older Australians and Americans. *Aust J Rural Health* 2008;**16**:33–9.
9. De la Rue M, Coulson I. The meaning of health and well-being: voices from older rural women. *Rural Remote Health* 2003;**3**:192.
10. Iezzoni LI, Killeen MB, O'Day BL. Rural residents with disabilities confront substantial barriers to obtaining primary care. *Qual Life Res* 2006;**41**:4.
11. Sabbah I, Drouby N, Sabbah S, Retel-Rude N, Mercier M. Quality of life in rural and urban populations in Lebanon using SF-36 Health Survey. *Health Quality Life Outcomes* 2003;**1**:30.
12. Tazaki M, Nakane Y. *A guide to WHOQOL-26*. Tokyo: Kaneko Shobo; 1997.
13. Kato Y, Hatada K, Tazaki M, Ishii Y, Ebihara Y, Takayama M, et al. QOL of the elderly in Japan — the results of the survey using the Japanese preliminary WHOQOL-OLD instrument. *Japanese J Geriatric Psychiatr* 2005;**16**:1057–67.
14. The WHOQOL Group. The World Health Organization quality of life assessment (WHOQOL): development and general psychometric properties. *Soc Sci Med* 1998;**46**:1569–85.
15. Tazaki M. Result of QOL research with Japanese elderly people — the results of WHOQOL-OLD instrument development study in Japan. *Qual Life Res* 2004;**13**:1498.
16. American Occupational Therapy Association. Occupational therapy practice framework: domain and process. *Am J Occup Ther* 2002;**56**:609–39.
17. World Health Organization (WHO). *International classification of functioning, disability and health (ICF)*. Geneva: WHO; 2001.
18. Ito E, Hatta T, Ito Y, Nagahara N, Hatta T, Kawaguchi K, et al. Effect of leisure activities on cognitive functions. *J Human Environmental Studies* 2003;**1**:15–20.
19. United Nations. *Department of Economic and Social Affairs, Population Division, World urbanization prospects: the 2012 revision*. New York: United Nations; 2012.
20. Nawi NG, Mohammad H, Byass P, Wilopo S, Wall S. Health and quality of life among older rural people in Purworejo District, Indonesia. *Global Health Action Suppl* 2010;**2**:78–87.
21. Tazaki M, Ishii Y, Ebihara Y, Origasa H, Takayama M, Hirose N, et al. QOL of the elderly in Japan — the results of the survey using the Japanese preliminary WHOQOL-OLD Instrument. *Japanese J Geriatric Psychiatr* 2005;**16**:1064–7.
22. Huisman M, Kunst AE, Mackenbach JP. Socioeconomic inequalities in morbidity among the elderly: a European overview. *Soc Sci Med* 2003;**57**:861–73.
23. Bassuk SB, Berkman LF, Amick III BC. Socioeconomic status and mortality among the elderly: findings from four US communities. *Am J Epidemiol* 2002;**155**:520–33.
24. Shevington SM, Lotfy M, O'Connel KA. The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results

Please cite this article in press as: Sewo Sampaio, PY, et al., The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas, Journal of Clinical Gerontology & Geriatrics (2013), http://dx.doi.org/10.1016/j.jcgg.2012.11.004

of the international field trial – a report from the WHOQOL Group. *Qual Life Res* 2004;**13**:299–310.
25. Tajima M, Nakane M. *A guide to WHOQOL-26*. Tokyo: Kaneko Shobo; 2007.
26. Power M, Quinn K, Schmidt S, WHOQOL-OLD Group. Development of the WHOQOL-Old module. *Qual Life Res* 2005;**14**:2197–214.
27. Aoyagi Y, Park H, Park S, Shepard RJ. Habitual physical activity and health-related quality of life in older adults: interactions between the amount and intensity of activity (the Nakanojo Study). *Qual Life Res* 2010;**19**:333–8.
28. Takata Y, Ansai T, Soh I, Awano S, Yoshitake Y, Kimura Y, et al. Quality of life and physical fitness in an 85-year-old population. *Arch Gerontol Geriatr* 2010;**50**:272–6.
29. Laslett P. *A fresh map of life: the emergence of the third age*. Cambridge, MA: Harvard University Press; 1996.
30. Bowling A. *Ageing well: quality of life in old age*. Maidenhead: Open University Press; 2005.
31. Kim HK, Hisata M, Kai I, Lee SK, Lee K. Social support exchange and quality of life among the Korean elderly. *J Cross-Cultural Gerontol* 2000;**15**: 331–47.
32. Gureje O, Kola L, Afolabi E, Olley BO. Determinants of quality of life of elderly Nigerians: results from the Ibadan study of ageing. *Afr J Med Med Sci* 2008;**37**: 239–47.
33. Spencer A. Ageing through occupation. *Asian J Occup Ther* 2001;**1**:15–21.

Please cite this article in press as: Sewo Sampaio, PY, et al., The association of activity and participation with quality of life between Japanese older adults living in rural and urban areas, Journal of Clinical Gerontology & Geriatrics (2013), http://dx.doi.org/10.1016/j.jcgg.2012.11.004

Geriatrics Gerontology Medline Indexed

Geriatr Gerontol Int 2013

ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Self-reported quality of sleep is associated with bodily pain, vitality and cognitive impairment in Japanese older adults

Ricardo Aurélio Carvalho Sampaio, Priscila Yukari Sewo Sampaio, Minoru Yamada, Tadao Tsuboyama and Hidenori Arai

Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan

Aim: Poor sleep can affect physical and mental health, and consequently people's quality of life (QOL); however, only a few studies have addressed the potential associations of physical and mental health with quality of sleep (QOS) in Japan. The present study aimed to investigate the association of QOS with sociodemographic and lifestyle characteristics, cognitive status, nutrition, depression, seclusion, and QOL in Japanese community-dwelling older adults.

Methods: Data were collected through self-administered questionnaires and other specific tests in 145 (age 73 years [range 70–77 years]) participants. The χ^2-test or Fisher's exact test were used to compare categorical variables stratified by QOS, and the Mann–Whitney *U*-test was used for continuous variables. Furthermore, logistic regression analyses were carried out to verify the associations with QOS.

Results: The poor QOS group had more males ($P < 0.05$), a shorter self-reported sleep duration ($P < 0.001$), higher body mass index ($P < 0.05$) and higher risk of depression ($P < 0.05$), whereas the good QOS group showed higher scores in the QOL summary and domains of physical component ($P < 0.01$), general health ($P < 0.001$), bodily pain ($P < 0.001$) and vitality ($P < 0.001$). In the logistic regression model, cognitive status (OR 0.13, 95% CI 0.03–0.55), bodily pain (OR 0.91, 95% CI 0.84–1.00) and vitality (OR 0.82, 95% CI 0.73–0.92) were associated with QOS.

Conclusion: The present study provides evidence that QOS is linked to cognitive status, bodily pain and vitality in Japanese older adults. We maintain that screening a person's sleep characteristics in a community setting might be relevant to identify those older adults at risk of a poor QOL and frailty in the early phase, triggering further health analyses. **Geriatr Gerontol Int 2013; ••: ••–••.**

Keywords: bodily pain, cognitive status, quality of life, quality of sleep, vitality.

Introduction

Sleep is a key factor for the restoration, maintenance and improvement of a person's health. Because sleep disturbance can affect physical and mental health, it consequently affects people's quality of life (QOL). Studies have identified that poor sleep quality is associated with chronic health dysfunctions[1] and depression,[2] and can be an early sign of physical[3] and cognitive decline.[4,5] Such conditions are observed especially in older adults who might experience changes in both the qualitative and quantitative aspects of their sleep pattern and distribution.[6]

Researchers have been challenged to develop research protocols to assess sleep characteristics in older adults due to the complex interactions and several confounding factors that are associated with the aging process; however, the importance of the studies related to this theme remains clearly relevant for public health.[6] Several methods are used for assessing sleep, including objective and subjective measurements; the "gold standard" of objective sleep measurement is polysomnography. Unfortunately, its use in research is not always feasible because of the intensive cost and labor. Overall, a common method to assess sleep includes self-report methods; however, one of the concerns about subjective reports regards its validity. Generally, the association between the objective and subjective sleep measures appears to be modest,[7] but studies have

Accepted for publication 31 July 2013.

Correspondence: Professor Hidenori Arai MD PhD, Department of Human Health Sciences, Kyoto University Graduate School of Medicine, 53 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan. Email: harai@kuhp.kyoto-u.ac.jp

doi: 10.1111/ggi.12149

shown that the subjective assessment is more sensitive to detect differences in one's sleep characteristics than the objective measurements. Regarding this, a study found significant differences of quality of sleep (QOS) between older chronic pain patients and a control group without sleep complaints, as assessed by their subjective sleep reports; however, with the exception of sleep duration, the groups did not differ in the actigraphically obtained measures of QOS.[8]

Hence, considering the modest results in the literature regarding the subjective quality of sleep and QOL of Japanese older adults, we carried out a study to investigate the self-reported QOS and its associated factors, such as sociodemographic and lifestyle characteristics, cognitive status, nutrition, depression, seclusion and QOL, in Japanese community-dwelling older adults. We hypothesized that sleep characteristics are related to important health measurements, and thus their screening in a community setting can be useful to identify older adults at risk of a poor QOL and frailty in the early phase, trigger further health analyses and determine the required approaches.

Methods

This study had a cross-sectional design.

Participants

The participants were community-dwelling Japanese older adults, recruited in western Japan through local press advertisements requesting healthy community-dwelling volunteers to collaborate in this research. We met all the subjects willing to participate on a specific day in November 2012; we explained the research protocol and then carried out the data collection, excepting pedometer. During tests, the participants were assisted by trained assistants. We recruited people aged 65 years or older who could carry out normal activities of daily living (ADL) and fill out the questionnaires. We excluded those individuals who had any of the following: (i) moderate or severe cognitive impairment (i.e. Mini-Mental State Examination [MMSE] score ≤21 points); (ii) uncontrolled cardiovascular, pulmonary or metabolic diseases; (iii) any orthopedic conditions that could restrain normal ADL; (iv) any type of surgery during the previous 3 months; (v) forced bed rest during the previous 3 months; or (vi) current treatment for cancer. All participants were informed of the purpose and procedures of the study, and written consent was obtained. A total of 179 participants were recruited to participate in this research; however, 34 of them were excluded from the analysis because they were aged lower than 65 years and/or missing data in questionnaires. A total of 145 participants met the criteria for the study and were willing to carry out the study procedures. Research procedures started in July, and data were collected in November 2012.

The study protocol was approved by the Kyoto University Graduate School of Medicine Ethics Committee (No. E1470, 2012).

Quality of sleep

The QOS was determined through a single question, "During the past month, how do you rate your sleep quality?", and the answers were provided on a four-point Likert scale with the following options: (i) very good; (ii) good; (iii) poor; and (iv) very poor. We dichotomized the QOS measure into very good/good (good; coded as 0) versus poor/very poor (poor; coded as 1).

General assessments

The participants answered a self-administered questionnaire regarding: (i) sociodemographic characteristics, such as age, living situation, educational level, current work and financial satisfaction; (ii) lifestyle and health condition regarding the frequency of smoking and alcohol consumption, number of medical consultations in 6 months, number of medications and morbidities; and (iii) other relevant health indicators, such as self-reported sleep duration, body mass index (BMI), regular practice of physical activity, pedometer counts in 14 days, MMSE, Mini-Nutritional Assessment (MNA), Geriatric Depression Scale (GDS), the Life-Space Assessment (LSA) and QOL.

The participants were asked about the presence of several morbidities (e.g. lower back pain, diabetes, osteoporosis, hypertension, hyperlipidemia, arthropathy and respiratory disease); their report was considered in the analysis when they were assumed to use prescribed medications for the specific morbidity. In addition, the presence of more than one chronic condition was included for analytical purposes.

The self-reported sleep duration referred to the time when the participants slept at night during the past month. Height and weight were measured, and the BMI was calculated as the bodyweight divided by height squared. For classification purposes, the considered BMI cut-offs were those proposed by the Japan Society for the Study of Obesity (i.e. underweight, BMI <18.5 kg/m^2; normal weight, BMI 18.5 to 25 kg/m^2; and obese, BMI ≥25 kg/m^2).[9]

Furthermore, regarding the pedometer data (Yamax Powerwalker EX-510; Yamasa, Tokyo, Japan), the participants were instructed to wear the instrument in the morning and register the number of steps in a diary at the end of the day. After 2 weeks, they were asked to send the pedometers and the diary record by mail to the researchers. The diary record was then matched with the pedometer memory, and the average of the step counts during the 2 weeks was used for the analysis.

Furthermore, well-recognized health screening tools in the health sciences literature were used to better identify the participants' general health characteristics: MMSE, for cognitive function in older adults;[4] MNA, for a rapid nutritional assessment;[10] GDS, for psychological characteristics;[11] and LSA, related to seclusion and decline in ADL and physical function.[12] QOL was verified by the Short-Form 8 items (SF-8), which is an abbreviated version of SF-36 and consists of eight questions (domains) regarding general health, physical functioning, role-physical, bodily pain, vitality, social functioning, mental health and role-emotional. Such domains were also considered as physical and mental component summaries, as previously specified.[13] A higher score in the SF-8 indicates a better QOL score.

Statistical analysis

The Kolmogorov–Smirnov test was used to verify the normality of the data. The data are presented as the median (interquartile range) or respective percentage. The χ^2-test or Fisher's exact test were used to compare groups stratified by QOS with respect to sex, education, living situation, work, financial satisfaction, smoking, alcohol, number of consultations in 6 months, number of medications, morbidities, comorbidities and regular physical activity categories. Additionally, the χ^2-test was used to compare the pedometer counts and LSA categorized according to values above or below the median (6562 steps/day and 86, respectively) due to their skewed characteristics, and the MMSE, MNA and GDS scores were categorized according to their respective cut-offs (i.e. 24, 12 and five, respectively). The Mann–Whitney *U*-test was used to compare age, BMI, self-reported sleep duration, and the SF-8 component summaries and domains. Logistic regression was carried out to analyze the potential associations for QOS in Japanese older adults. Sociodemographic, lifestyle and health condition variables were analyzed one by one as covariates in a partially adjusted model by sex and self-reported sleep duration. Finally, variables that reached $P < 0.1$ in the partially adjusted model (e.g. comorbidities, MMSE, GDS, LSA, SF8 physical and mental component summaries, general health, bodily pain, vitality, social functioning, and mental health) were inserted in a fully adjusted model, and analyzed as covariates considering QOS as a dependent variable. Statistical significance was set at $P < 0.05$. All analyses were carried out using the Statistical Package for the Social Science program version 20.0 (SPSS; IBM, Chicago, IL, USA).

Results

A total of 145 subjects participated in the present study; they were then divided according to their QOS report into good sleep ($n = 115$) and poor sleep ($n = 30$) groups. In addition, the data in tables are also presented as the total sample. Their sociodemographic characteristics are shown in Table 1. No significant difference was found with respect to age; however, regarding sex, more males had a poor QOS ($P < 0.05$). Additionally, no significant differences were found for educational level, living situation, current work or financial satisfaction.

Regarding lifestyle and health conditions, the current number of smokers was less than 10% of the total participants, and less than 50% of the participants drank alcohol. There were no differences in the consultation frequency in 6 months, number of medications or morbidities (Table 2).

We found significant differences in the self-reported sleep duration ($P < 0.001$), BMI ($P < 0.05$), GDS ($P < 0.05$), SF-8 – physical component summary ($P < 0.01$), general health ($P < 0.001$), bodily pain ($P < 0.001$) and vitality ($P < 0.001$) between those individuals who evaluated their QOS as good and as poor. The poor QOS group had a shorter self-reported sleep duration, higher BMI and higher risk of depression than the good QOS group.

Furthermore, the good QOS group showed significantly higher scores in the different QOL summaries and domains: SF-8 – physical component ($P < 0.01$), general health ($P < 0.001$), bodily pain ($P < 0.001$) and vitality ($P < 0.001$). No significant differences were found regarding regular physical activity, pedometer counts or other variables (Table 3).

In the partially adjusted model (by sex and self-reported sleep duration), BMI and GDS failed to remain significantly different between groups. However, having a normal cognitive condition appeared to be a protective factor against poor QOS (odds ratio 0.24, 95% confidence interval [CI] 0.07–0.83). The SF-8 physical component summary, general health, bodily pain and vitality domains remained significant. Comorbidities ($P = 0.06$), LSA ($P = 0.05$), SF-8 mental component summary ($P = 0.06$) and mental health ($P = 0.05$) showed a tendency towards significance. Those individuals with higher QOL scores were less likely to assess their QOS as poor (Table 4).

In Table 5, a fully adjusted model was analyzed in a stepwise logistic regression method. Considering this model, MMSE (odds ratio 0.13, 95% CI 0.03–0.55), bodily pain (odds ratio 0.91, 95% CI 0.84–1.00) and vitality (odds ratio 0.82, 95% CI 0.73–0.92) were then confirmed as protective factors for participants who evaluated their QOS as poor.

Discussion

To our knowledge, only a few studies have investigated QOS in Japanese older adults, and none have directly analyzed the associations of QOS with a broad range of