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Original Article

Changes in caregiving risk and motor function among older adults participating in community gatherings in Koshigaya city

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Abstract. [Purpose] This study investigated the changes in caregiving risk and motor function among older adults participating in community gatherings ("Kayoinoba") in Koshigaya. [Participants and Methods] A total of 257 older participants who engaged in the Kayoinoba program for 6 months from its inception were included in the analysis. Caregiving risk and motor function were assessed twice—once at the beginning of the Kayoinoba (first assessment) and again 6 months later (second assessment). The Kihon Checklist was used to evaluate caregiving risk, and the timed up-and-go, one-leg standing, and 30-s chair-stand tests were done to evaluate motor functioning. Participants were divided into pre-frail and healthy groups, and the first and second assessments were compared. [Results] The Kihon Checklist score of the pre-frail group significantly improved from the first to the second assessment. The pre-frail group had lower composite scores for physical function, outdoor activities, and depression mood items based on the Kihon Checklist; the healthy group showed no such differences. Performance on the 30-s chair-stand test was significantly better in the second assessment than in the first assessment in both groups. [Conclusion] The findings of this study emphasize the benefits of participating in Kayoinoba among high-risk older adults and provide the knowledge for developing a healthier community-based symbiotic society.
Key words: Kayoinoba, Kihon Checklist, Pre-frailty

INTRODUCTION

Following the 2006 revision of the Japanese long-term care insurance system, there was a shift in focus regarding the prevention of long-term nursing care from providing nursing care services to prioritizing prevention systems. Since the implementation of the community-based integrated care system in 2011, various initiatives have been undertaken to enable older adults to live in the communities they know in a manner that suits them[1]. Among the components of the community-based integrated care system, fostering social participation among older adults emerges as a pivotal element in promoting comprehensive and effective older adults' care. Thus, attention has recently focused on creating an environment where older adults can actively participate in the local community.

A notable general preventive care initiative is the community gathering place ("Kayoinoba") concept[2, 3]. Kayoinoba is a community support program where older individuals, equipped with specific knowledge, become leaders and form groups

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within their residential areas, engaging in activities such as exercises and various forms of social participation. The distinguishing feature of the gathering place is its community-driven nature, which makes it easily accessible for participation and allows for maintaining connections with the local community while utilizing services. Therefore, it can be a crucial social participation hub for older adults in their respective regions. Kayoinoba has been launched in many municipalities throughout Japan. Studies have reported that participating in Kayoinoba maintains physical function[4], boosts social participation[5], and reduces the risk of requiring support or long-term nursing care[6]. From the above, it is evident that participation in Kayoinoba is effective in maintaining and improving mental, physical, and life functions.

Promoting social participation may improve the health of frail older adults[7]. Therefore, the aim of Kayoinoba is to actively encourage community participation among older adults aged ≥75 years and frail older adults[8]. However, although the participation rate of healthy older adults is high in such community gatherings[9], frail older adults, the target population, tend to limit their participation due to physical, mental, and environmental factors. Therefore, achieving this aim requires accurate communication of the merits of participation in Kayoinoba to encourage frail older adults to participate. In Japan, a questionnaire called the Kihon Checklist (KCL) is widely used for screening for caregiving risk. Moreover, the KCL is a valuable index in identifying frail older adults[10, 11]. We can verify the effect of Kayoinoba participation in older adults that were deemed frail based on easily collectible KLC scores. Should these benefits be further substantiated, they might motivate older adults identified as frail by the KLC scores to become more involved in "Kayoinoba".

Koshigaya is a city with a population of approximately 350,000. In 2020, older residents accounted for >25% of the population, necessitating programs to prevent the need for long-term nursing care. In 2016, the local government began setting up Kayoinobas in Koshigaya, forming 41 groups to date that are involved in various activities focusing on exercise. Therefore, this study retrospectively investigated changes in nursing care and motor function risk among community-dwelling older adults in Koshigaya City who participated in Kayoinoba. Using a KCL, participants were classified into frail (or pre-frail) and healthy groups, and a threshold KCL score was determined for the elderly who would benefit from participation in a place for commuting. Demonstrating that Kayoinoba is effective for older adults in the frail reserve group may be an essential finding for maintaining the willingness of frail older adults to participate in Kayoinoba. In addition, clarification of the threshold of caregiving risk level could be an important indicator for caregiving professionals, such as public health nurses involved in the community, to encourage the elderly in the community to participate in Kayoinoba.

PARTICIPANTS AND METHODS

This retrospective cohort study included community-dwelling older adults who participated in Kayoinoba from September 2016 to October 2021. Among the Kayoinoba sessions conducted at 41 locations in Koshigaya, caregiving risk and motor function assessments were conducted during the inaugural sessions of Kayoinoba (first assessment), and again six months later (second assessment). Although the starting data for Kayoinoba varied by location, we standardized the initial assessment to the beginning of Kayoinoba and the follow-up assessment to six months thereafter. Participants were recruited using advertisements, including fliers and notices. Community leaders who led the efforts to establish the Kayoinoba groups primarily recruited the participants. The participants with assessment data available for the first and second assessments were included in the study, while those with missing or irregular data were excluded.

The process leading up to establishing Kayoinoba groups in each region was as follows. First, a 10-lesson "Long-Term Care Requirement Prevention Leader Training Course" was conducted to groom residents with the potential to lead Kayoinoba. This course trained them in exercises to be taught at Kayoinoba and pertinent risk management methods. These residents acted as leaders in soliciting participation in Kayoinoba in their residential areas and setting up Kayoinoba. A single Kayoinoba session spanned approximately 90 min to 2 h, with exercise taking 40–60 min. The remaining time was used at the participants' discretion, such as for other exercises or teatime, resulting in a different program for each Kayoinoba. After establishing a Kayoinoba program, we visited it five times in six months, providing additional instructions regarding exercising and risk management. Subsequently, each Kayoinoba program was run independently, primarily by its leader. Furthermore, since they participated in the programs, the leaders of each Kayoinoba were also included in the analysis.

Among the activities at the Kayoinoba, the following four types of exercises were consistently performed: 1) dynamic stretching as a warm-up, 2) "Koshigaya Rakunobi Exercise", which consists of resistance exercises for the upper and lower limbs using Therabands, 3) "Rakusho Exercise", in which automatic movements are performed while singing to improve the oral and respiratory functions, and 4) static stretching for cool-down.

The survey included the KCL and items for assessing motor function. The KCL, a 25-item self-administered questionnaire that assesses lifestyle and mental and physical functioning with "yes" or "no" responses, was developed to screen for older adults at risk of requiring long-term nursing care in the future[10, 11]. It consisted of seven assessment categories with seven items on instrumental and social activities of daily living (ADL), five on physical function (PF), two on nutritional status (NS), three on oral function (OF), two on outdoor activities (OA), three on cognitive function (CF), and five on depressed mood (DM).

Motor function was assessed with the timed up-and-go test (TUG), the one-leg standing test, and the 30-s chair stand test (CS-30). TUG, widely used as an indicator of lower-extremity muscle strength and mobility, measures the time required to stand up from a chair, walk to a point 3 m away, turn back, and sit in the chair again[12]. A shorter TUG time represents greater

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mobility. The one-leg standing test assesses balance by measuring the time a participant can stand on a leg with the other leg elevated and eyes open[13]. In the present study, one-leg stance data from the right lower limb were utilized, with a longer time representing better balance. CS-30, a simple assessment of lower-extremity muscle strength[14], measures the number of times the participant stands up from a chair in 30 s[15]; the higher this number, the better the function. Specifically, assessments were performed in the first and the second assessments, separated by 6 months of Kayoinoba, and were conducted by physical therapists who visited Kayoinoba sessions.

The composite KCL score was calculated as the sum of the scores for the 25 items. With a maximum possible score of 25, a higher score represented a greater risk of requiring long-term nursing care. Measurements of motor function assessment were used as is in the analysis. First, the study compared the KCL and motor function assessment scores between the first and second assessments to assess the effect of the four-exercise Koshigaya Kayoinoba program on the participants' caregiving and motor functions. Next, participants were classified into two groups, a healthy group, and a pre-frail group, and the first and second assessments were compared. Based on previous studies[10], participants who scored 4 or more points on the KCL were defined as the pre-frail group, and those who scored less than 4 points were defined as the healthy group. The pre-frail group included frail elderly participants who scored 8 or more points. Demographic information for each group is shown in Table 1. The total score for each KCL category (ADL, PF, NS, OF, OA, CF, and DM) was also calculated. Therefore, for comparing the first and second assessments after classification into two groups, the total score of the KCL, the total score of each category, and the measures of motor function were compared.

Paired t-tests were performed to compare variables following normal distribution patterns, and Wilcoxon signed-rank tests were used for those that did not follow a normal distribution. For all analyses, $p < 0.05$ was considered statistically significant. Statistical analyses were performed with the numeric analysis processing platform MATLAB R2022a (MathWorks Inc, Natick, Massachusetts, MA, USA). This study was approved by the ethics review committee of Saitama Prefectural University (approval number: 22037).

RESULTS

A total of 851 people participated in the Kayoinoba. Of these, 594 were excluded from the study (290 had data only for the first period (dropped out), 140 had data only for the second period (joined midway through the study period), and 164 had incomplete data). Finally, 257 (257/851) were included in the study (Fig. 1).

There were no significant differences in the total KCL score when comparing the first and second periods for all 257 participants. Motor function was significantly higher in the second period only for the CS-30 ($p < 0.001$; Table 2).

Next, the results were classified into the healthy and pre-frail groups and compared within each group in the first and second periods (Table 3). In the pre-frail group, the total KCL score was significantly lower in the second assessment than in the first assessment ($p < 0.001$). On the other hand, in the healthy group, scores were significantly higher in the second

Table 1. Participants' demographics

	Pre-frail group (n=136)	Healthy group (n=121)
Age (years)	76.1 ± 6.7	73.2 ± 5.5
Sex, n (male/female)	25/111	15/106

Participants with a KCL score ≥4 were assigned to the pre-frail group, and participants with a KLC score <4 were assigned to the healthy group.
KCL: Kihon Checklist.
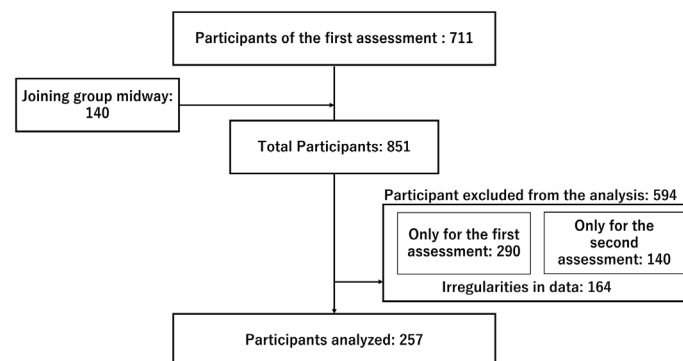
Fig. 1. Flowchart showing the selection of participants for analysis.

Table 2. Comparison of Kihon Checklist and motor function between the first and second assessments

N=257		First assessment Mean ± SD	Second assessment Mean ± SD
Kihon Checklist (items 1–25)		4.4 ± 3.2	3.9 ± 3.2
Motor function	TUG (s)	6.8 ± 1.8	6.9 ± 1.8
	One leg standing (S)	34.1 ± 39.5	37.8 ± 41.6
	CS-30 (times)***	20.7 ± 5.6	22.3 ± 6.0

***p<0.001.
TUG: Timed up and Go test; CS-30: 30-second chair stand test; SD: standard deviation.

Table 3. Comparison of Kihon Checklist and Motor Function between the first and second terms among the Pre-frail and Healthy groups

		Pre-frail group (n=136)		Healthy group (n=121)	
		First assessment Mean ± SD	Second assessment Mean ± SD	First assessment Mean ± SD	Second assessment Mean ± SD
Kihon Checklist (items 1–25)		6.5 ± 2.6	5.4 ± 3.3***	1.7 ± 1.0	2.1 ± 1.9*
Kihon Checklist (individual categories)	ADL	0.7 ± 1.1	0.6 ± 0.9	0.1 ± 0.3	0.2 ± 0.5
	PF	1.8 ± 1.0	1.6 ± 1.2*	0.6 ± 0.7	0.7 ± 0.9
	NS	0.2 ± 0.4	0.1 ± 0.4	0.1 ± 0.2	0.1 ± 0.2
	OR	0.9 ± 0.8	0.8 ± 0.8	0.4 ± 0.6	0.4 ± 0.7
	OA	0.5 ± 0.6	0.3 ± 0.5***	0.1 ± 0.3	0.1 ± 0.4
	CF	0.7 ± 0.8	0.6 ± 0.7	0.1 ± 0.3	0.2 ± 0.8
	DM	1.7 ± 1.4	1.4 ± 1.4**	0.1 ± 0.6	0.3 ± 0.8
Motor function	TUG (s)	7.3 ± 1.8	7.3 ± 2.1	6.4 ± 1.1	6.4 ± 1.1
	One-leg standing (s)	23.0 ± 32.0	23.0 ± 30.1	48.2 ± 44.0	46.0 ± 43.6
	CS-30 (times)	19.5 ± 5.6	21.0 ± 6.3***	22.4 ± 4.5	23.8 ± 5.3***

*p<0.05, **p<0.01, and ***p<0.001.
ADL: activity of daily living; PF: physical function; NS: nutritional status; OR: oral function; OA: outdoor activity; CF: cognitive function; DM: depressed mood; TUG: Timed up and Go test; CS-30: 30-second chair stand test; SD: standard deviation.

assessment than in the first assessment (p=0.04). For each category, scores for PF (p=0.04), OA (p>0.001), and DM (p=0.01) were significantly lower in the pre-frail group in the second assessment than in first assessment. The healthy group had no significant differences in any of the categories. Concerning motor function assessment, there were no significant differences in the TUG test and one-leg standing time between the first and second assessment in either group. On the other hand, CS-30 was significantly higher in the second assessment in both groups (p<0.001).

DISCUSSION

In this study, we investigated changes in caregiving risk and motor function between two groups (pre-frail group and healthy group) classified by the KCL among community-dwelling elderly in Koshigaya City. The results showed that the caregiving risk and motor function were improved in the pre-frail group who scored 4 or more points on the KCL. As the results of this study suggest, a KCL score of 4 points may be an important indicator for the promotion of active participation in the Kayoinoba among the elderly who fall into the category of pre-frail.

The composite KCL score (items 1−25) measured during the first and second assessments did not differ significantly when the results of all the participants were combined. The participants were then divided into pre-frail and healthy groups, using a KCL score of 4 as the cutoff[10]; each measurement was compared between each group's first and second assessments. The pre-frail group scored significantly lower in the second assessment than in the first. KCL is used to screen older adults at risk for long-term nursing care in the future[10, 11]. Furthermore, several studies have reported that KCL items can be used to predict the necessity of long-term care[16, 17]. Kayoinoba has been reported to alleviate the risk of requiring long-term nursing care[6, 18], a possible reason for an observed reduction in KCL score for the pre-frail group after Kayoinoba participation.

In addition, the scores of the three items of the basic checklist (PF, OA, DM) were significantly lower in the second assessment compared to the first assessment of the pre-frail group. Furthermore, significant improvement was observed in the CS-30 motor function assessment. The improvement of PF in the KCL and CS-30 in the motor function assessment may be due to the increase in the frequency of outings associated with participation in the Kayoinoba and the implementation of

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exercises in the Kayoinoba, which may have led to the improvement of motor function. In previous studies, CS-30, which is associated with knee extension strength, has been used as a simple indicator to evaluate lower limb muscle strength[14, 15, 19]. At a Kayoinoba, the exercise program includes "Koshigaya Rakunobi Exercise", a resistance exercise using Therabands, and "Rakusho Exercise", an active exercise for the lower limbs, in which the limbs are actively exercised while singing songs. These exercises could have affected the lower-extremity muscle strength of participants and improved CS-30 results in our study. OA evaluates whether the participant goes out socially[11]. Since participation in Kayoinoba already provided an opportunity to venture out of their residences, significant improvement was likely observed among older people who were not going out frequently, particularly among those in the pre-frail group. In a previous study, participants in Kayoinoba involving original exercise demonstrated improved self-rated health and increased participation in social activities even a year later[20]. Notably, expanding social support and social networks through Kayoinoba programs and receiving useful information for maintaining health has favorable effects on physical and mental health[5, 21]. Older people tend to be more satisfied and happier in situations with community cohesion and a sense of belonging[22], suggesting that community-based group activities like Kayoinoba are effective for improving the mental health of the participants, such as those with DM in our study. Therefore, this study demonstrated that Kayoinoba in Koshigaya, consisting of four types of exercises, can reduce the risk of requiring caregiving by improving physical and mental function and increasing the frequency of social participation among older people at high risk for nursing care.

Conversely, the healthy group in our study demonstrated a significantly higher composite KCL score (items 1−25) in the second assessment than in the first assessment. Nevertheless, the group's mean was still lower than the cutoff scores of KCL (4 points) corresponding to the pre-frail group. Additionally, no significant differences were observed in any individual domain assessed. Therefore, the intensity of exercise and frequency of social participation at Kayoinoba did not affect the risk of requiring caregiving in healthy older adults.

Neither group showed significant improvement over time concerning TUG or one-leg standing time. The TUG test score has been reported to be highly associated with lower-extremity muscle strength and balance[23, 24]. Similarly, one-leg standing time is used to indicate lower-extremity muscle strength[25] and balance in a broader sense, as can be inferred from its inclusion in the Berg Balance Scale[26]. Significantly, Kayoinoba, which mainly focuses on strength training, might not affect balance. As for the TUG test, the initial values were good. The cutoff value for the TUG test has been reported to be 13.5 s[27], while the mean TUG test time among the participants in the present study was 6.84 s, a value <7 s. Thus, most participants had a high gait capacity in the first assessment, with the absence of a change possibly due to a ceiling effect. Based on these findings, both pre-frail and healthy groups demonstrated changes in lower-extremity muscle strength but not in functions such as balance.

This study excluded 594 out of 851 participants from the analysis. Specifically, as shown in Fig. 1, 290 participants dropped out during the study period. Moreover, supplemental analysis of the data of participants excluded from the analysis showed that their KCL (items 1–25) scores were <4, and their motor function assessment scores were similar to those of the healthy group (Additional file 1), indicating that most of the excluded participants were older adults with high levels of motor function who were at low risk for caregiving. This study showed that the current Kayoinoba program is effective for those with pre-frailty. Still, different programs must be considered to maintain high motor function and a low-risk status for caregiving in healthy older adults.

This was a retrospective cohort study, implying the inability to collect underlying information affecting participation in Kayoinoba initially. Notably, participation in Kayoinoba could be restricted by factors such as family environment, disease, and economic status; therefore, as we continue our research from various perspectives, we intend to collect this information.

Participation in "Kayoinoba" emphasizes the benefits for high-risk older adults and offers insights for fostering a healthier community-based symbiotic society. The involvement of older individuals in community gatherings can potentially reduce caregiving risks and enhance motor functions. Remarkably, participants in the pre-frail group showed significant improvements in physical function, outdoor activities, and mood-related to depression. These results suggest that community-based activities can aid in improving the health and quality of life of the elderly.

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