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Short Communication

Evaluation of Long-term Preventive Care Activities for the Elderly -10year tracking survey of fitness tests-

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1 Introduction

The prevention of long-term geriatric nursing care is an urgent task for Japan, a country which is about to become a super-aged society.

The number of people certified as being in need of long-term care (or support) was 2.18 million in 2000 when the government of Japan began enforcement of the Long-Term Care Insurance Act, and that number had nearly tripled by 2015, reaching 6.3 million[1]. Under these circumstances, preventive care services managed by local municipalities should bear the responsibility for curbing the increasing trend in the number of elderly citizens who are certified as being in need of long-term care (or support)[2-4].

These community-supportive preventive care services, introduced after a revision was made to the Long-Term Care Insurance Act in fiscal 2006, changed forms to become general preventive care services in fiscal 2015 following a series of legal amendments requiring care preventive services to be provided in a combined manner without separating out fragile elderly people, who are subject to secondary prevention, from healthy elderly people, who are subject to primary prevention[5].

Regarding general preventive care services, local governments are required to set up places throughout each municipality where both healthy and fragile elderly citizens can get together and continue to take part in preventive care activities managed by community initiative. In order to develop and expand general preventive care services even further, however, we need to introduce new viewpoints that have been mostly overlooked to date, such as the specific behavioral patterns and sense of value of elderly citizens who live in local communities.

Daito City, the municipality in which this study was conducted, had a population of 123,321 as of March 2016 with a population aging rate of 25.4%. Of its 31,351 elderly citizens aged 65 years old or over, 5,706 (18.2%) had been certified at that time as being in need of long-term care (or support) under the nation's Long-term Care Insurance System. With its western border being adjacent to Osaka City and its eastern end neighboring Ikoma City, which is part of Nara Prefecture, Daito City serves as a bedroom community for Osaka and Nara prefectures.

In 2005, setting a precedent for the preventive care movement throughout the country, Daito City in Osaka Prefecture initiated efforts to spread the use of its originally developed health-promoting physical exercise program named "Daito Genki-demasse Taiso" (literally meaning exercise designed to make you feel energized; hereinafter called "Daito Energizing Exercise"), and as of December 2016, a total of approximately 1,700 elderly citizens from 97 regional groups across the city had participated in the program almost once a week on a continuing basis. The exercise program, in which community residents are supposed to play a leading role, has been conducted under a supportive framework in which healthy elderly citizens are expected to help their fragile peers. Elderly citizens having widely different physical conditions have been joining the exercise scheme, including those subject to primary or secondary prevention, senior citizens certified as being in need of support, and fragile elderly residents who are in need of intensive nursing care and classified as level 5, the highest level of requirement for long-term care under the nation's Long-term Care Insurance System.

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These community-wide preventive care services have not only helped participants to improve their physical strength but have also led to the expansion of social interactions among the elderly, bringing about beneficial effects on the promotion of both mental and physical fitness and preventing situations in which elderly citizens isolate themselves from society.

The objectives of the present study were to follow the time course of the changes in the physical strength and medical costs of the initial participants who joined the program when it was first introduced in Daito City in fiscal 2005 and to clarify what effects the long-term preventive care activities could have had on the elderly citizens.

2 Methods

2.1 Changes in physical strength caused by long-term preventive care activities among elderly citizens

Subjects: Of 132 elderly citizens who joined the Daito Energizing Exercise Program in fiscal 2005, 41 people were selected who had taken part in physical strength and fitness tests, which were conducted by the municipal government for program participants, on a continuous basis since fiscal 2005 (the shortest period of participation was 6 years; the longest was 10 years). Table 1 shows the average ages of the participants at the time of initiation of the exercise program and a breakdown of the numbers of men and women.

Evaluation contents: The following two tests were selected: one-leg standing with eyes open and the Timed Up and Go (called hereinafter the TUG).

Analytical methods: We performed the t-test and multiple comparisons according to continuous years of exercise participation.

2.2 Effects of long-term preventive care activities among elderly citizens on medical costs

Subjects: The subjects were 54 elderly citizens who started to exercise in fiscal 2005 (mean age:70.7 years; range:66-80 years). At the time of this report, four of these citizens continue to join the program.

Evaluation contents: For each subject, we randomly selected 10 citizens of the same age and gender living in the same area as the subject and selected from them the one, who acted as the control, with medical costs for fiscal 2004, the year before initiation of the exercise program, that were the closest to those of the subject. We then made comparisons between the changes in annual medical costs of the subject and the control for five years starting from fiscal 2004.

Analytical methods: We performed multiple comparisons of the changes in the total annual medical costs of the 54 subjects and 54 controls.

3 Ethical considerations

The participants in the Daito Energizing Exercise Program, some of whom were selected as the subjects of this study, provided written consent every year to Daito City, accepting self-responsibility for participation in the exercise program and allowing the municipal government to use individual data that were expected to contribute to preventive care services. The authors used individual data in a careful manner so that they would not identify any particular individual.

Table 1 Average ages of the participants at baseline depending on continuous years of exercise participation and a breakdown for men and women

		Men	Women	Overall
6 years of participation	Number	17	24	40
	Mean age	75.4	75.6	75.5
	Renge	70-82	65-84	65-84
7 years of participation	Number	13	25	32
	Mean age	77.5	76.0	76.8
	Renge	72-84	65-86	65-86
8 years of participation	Number	7	19	21
	Mean age	77.6	79.1	78.4
	Renge	73-85	67-88	67-87
9 years of participation	Number	4	9	13
	Mean age	79.3	78.9	79.1
	Renge	74-85	74-89	74-89
10 years of participation	Number	4	6	10
	Mean age	80.5	78.5	79.5
	Renge	81-87	75-82	75-87

4 Results

4.1 Changes in physical strength

In the TUG, the analytical results of the t-test revealed a significant difference at around six years after the start of the program among those who continued to exercise for six years (6-year participants), at around seven years among 7-year participants, and at around six and seven years among 8-year participants. In the one-leg standing with eyes open test, no significant difference was found among those who continued to join the program for six years or longer, whereas a tendency for improvement was observed among those who continued the activities for 6-8 years. The 9-year participants and 10-year participants were found to have been able to maintain their baseline levels. In addition, the analytical results of multiple comparisons demonstrated a significant difference only in the TUG tests at around five and seven years after the start of the activities among 7-year and 8-year participants, while no significant difference was found in the one-leg standing with eyes open tests (Fig. 1).

Regarding the changes in physical strength among dropouts who quit participating in the exercise program in the middle of the study, no significant differences were confirmed in physical strength during the six-year period among those who continued

to exercise for six years and quit doing so in the seventh year. Similarly, no significant differences were observed in physical strength throughout the exercise period among those who dropped out in the eighth and tenth years, respectively. Regarding the changes in physical strength during the eight-year period among those who dropped out in the ninth year, no significant differences were found in the one-leg standing with eyes open tests, but significant differences were demonstrated in the TUG tests (Fig. 2).

4.2 Changes in medical costs

In 2004, annual medical costs totaled 13,186,114 yen for the subjects and 13,486,025 yen for the controls. In 2009, they were 18,748,431 yen for the subjects and 23,658,210 yen for the controls. The figures rose year after year both for the subjects and the controls, with the total medical costs of the controls surpassing those of the subjects in every fiscal year. Whereas the difference in total medical costs between the subjects and the controls was 299,911 yen in 2004, the gap widened in the subsequent five years to reach 4,909,779 yen in 2009, showing that the gap in total medical costs between these two groups expanded over time, with the difference per person being 92,647 yen on average.

On an individual basis, the widest gap in medical costs between the lowest-spending subject and highest-spending control was 4,336,960 yen in 2009.

In addition, the analytical results of multiple comparisons demonstrated no significant differences in the changes in total annual medical costs among the subjects between any fiscal years, while significant differences in total medical costs were found in the controls among fiscal 2004, 2008, and 2009 (Fig. 3).

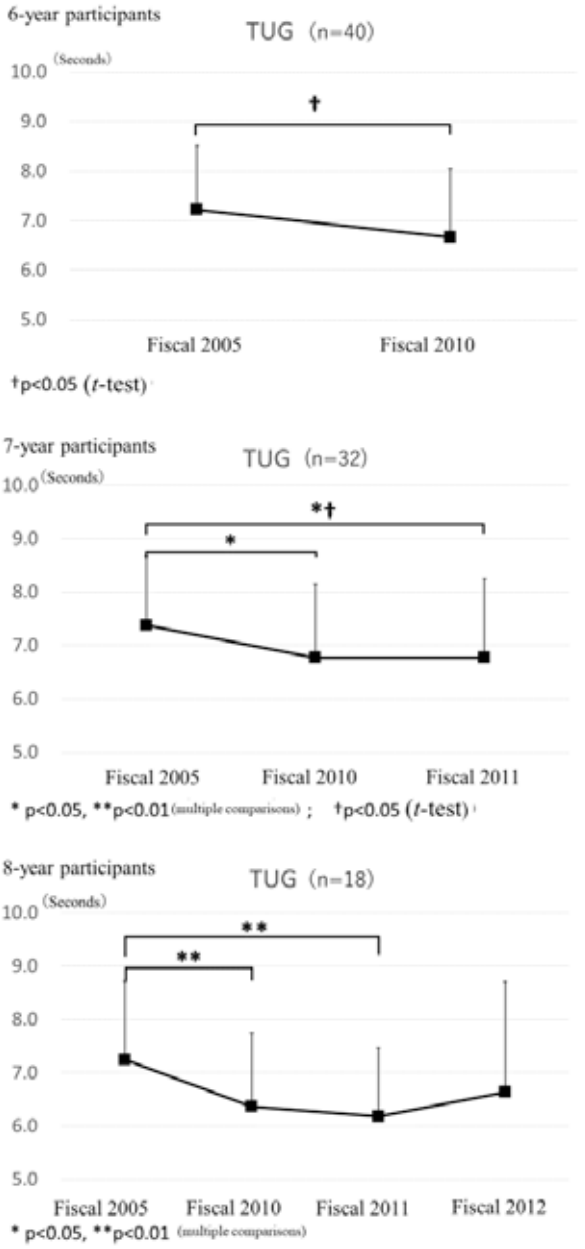

Fig.1 Changes in physical strength among senior citizens who continued to exercise for 6-8 years

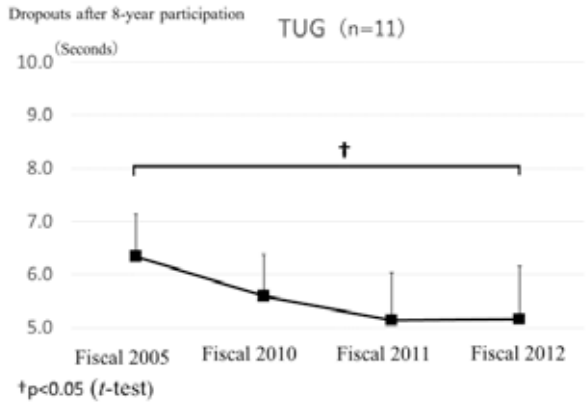

Fig.2 Changes in physical strength of dropouts (senior citizens who quit exercising after 8 years of participation)

5 Discussion

A preceding study suggested that regular physical activities and exercise in advanced stages of life could lead to improvement in both mental and physical functions and an independent lifestyle, a decrease in morbidity and mortality, and prevention of dementia and depression[6]. The results of our present study revealed that a community-wide approach to preventive nursing care in Daito City based on long-term participation by senior citizens in regular exercise activities resulted in improvement in their physical strength for an extended period of time. Shigematsu et al.[7] reported that it was easier for the elderly to continue exercising if they did so with peers. Similarly, our results suggested that the Daito Energizing Exercise Program devised by the Daito municipal government played a role in encouraging continuous participation in that

senior citizens joined the exercise program together with other residents at a familiar community center or public hall in a nearby area and performed exercise regularly every week at the same place together with other community members whom they may have exchanged greetings with on the street previously but were otherwise unknown. Participation in the program provided them with time together to exchange and share various kinds of information and to deepen ties and build up a sense of fellowship.

In order to prevent elderly citizens from isolating themselves from society, it is important to encourage them to become part of the community before they adopt an isolated lifestyle so that they can maintain a role in society and engage in intellectual activities. Shinkai[8] reported that social engagement is a generic term that indicates a wide variety of types and forms of participation in group activities, such as work, hobbies, taking lessons, lifelong learning, and volunteer activities, which, along with living behaviors, have the greatest impact on the energy consumption of elderly people. When elderly people engage in any kind of "participation" or "activities," their energy consumption would naturally increase. A populational approach to preventive nursing care suggests that we should assist the promotion of social participation and the activation of daily living behaviors of elderly people with the goal of attaining active aging or productive aging.

This belief is in accordance with the International Classification of Functioning, Disability and Health (ICF) model proposed by the WHO in 2001[9]. The ICF recognizes that three domains—body functions and structure, activities, and participation—are interrelated with each other.

Shinkai et al.[10] proposed classifying "homeboundness" of elderly citizens into type 1, in which individuals isolate themselves from the social community because their level of mobility is low, and type 2, in which individuals isolate themselves from the social community despite the fact that their level of mobility is relatively high. Meanwhile, Murayama et al.[11] reported that relative factors commonly observed in both homeboundness types were regular exercise habits and participation in community activities.

Based on these reports and other findings, it is assumed that the Daito Energizing Exercise Program has been playing a role in the prevention of isolation (homeboundness) because it ensures regular exercise habits and participation in regional activities among elderly participants before they adopt an isolated lifestyle.

According to our research survey on medical costs, it was found that although medical costs rose in both the exercise and non-exercise groups over the course of the fiscal years covered by the study, the difference between these groups widened. The gap in medical costs between the exercise and non-exercise groups reached an average of 90,000 yen or more on an annual basis.

The present study revealed that the preventive care services introduced by Daito City have been exerting a beneficial effect on the physical strength and medical costs of the elderly citizens who took part in the exercise program for an extended period of time.

Nakano et al.[12] reported that since social participation and continuance of physical exercise are interrelated, it is necessary to set up places in regional communities where senior residents can get together and to extend support to encourage their social engagement with the aim of developing a community where

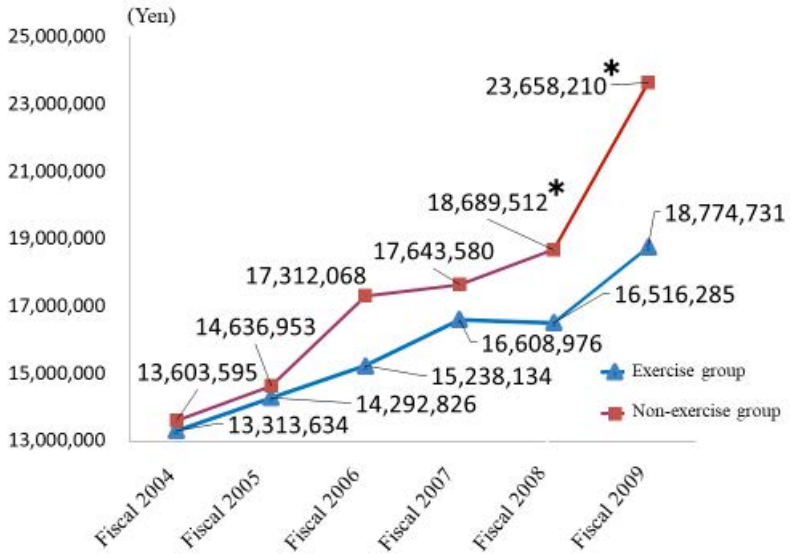

Fig.3 Comparisons of annual medical costs between the exercise group and non-exercise group (n=108)

senior citizens can take part in social activities easily. In addition, regarding the frequency of interactions among the elderly, Nakamura et al.[13] indicated that the more socially interactive days an elderly person has per week, the more frequently he/she goes out during the week, suggesting that it is important to adopt an approach to help senior citizens maintain a certain level of activeness according to their degree of independence and to provide opportunities for increased social interactions with others. They also mentioned that by creating an environment where senior citizens can interact with people and society in an active manner before they separate themselves from the outside world and providing sites and opportunities for interactions (though they may be passive), we could increase interactive occasions and prevent the elderly from being in need of long-term care even if they adopt an isolated lifestyle.

Based on these findings, an effective means of enhancing preventive care would be to set up accessible places throughout the community where fragile elderly citizens living in the vicinity who are subject to secondary prevention can get together easily with a light heart and to create opportunities for them to interact with other residents in the neighborhood.

In sum, maintenance and improvement of physical strength of senior citizens, promotion of their social interactions with others, and enhancement of a healthy lifestyle among them could be significant factors for the elderly to continue to live a vibrant life.

As a limitation of this study, the analytical power of the statistics was limited due to the small number of subjects, as we only included senior citizens who continued to exercise for six consecutive years starting in fiscal 2006. In a future study, it would be possible to analyze the changes in physical strength of a larger number of elderly who participate in exercise on a continuous basis by including those who, as determined at that time, have continued to join the program for a longer duration in years than the present subjects.

We plan to conduct a further investigation to clarify factors related to the continuance of physical exercise and how changes in physical strength would have an impact on the daily lives and activities of elderly citizens.

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