Effects of Long-Term Comprehensive Health Education on the Elderly in a Japanese Village: Unnan Cohort Study

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This study aimed to investigate how long-term biweekly participation in health education classes has affected the maintenance of independent lifestyle, care needs, and 10-year (125-month) mortality rates in Yoshida Village, where individuals among the community residents aged 58 years or older, participate in health education classes (*Silver College*). There were 1,013 people in total (male; n=456, 65.5±5.6y. and female; n=557, 71.5±9.5y.) on baseline in 1994. We examined participant gender, birth date and care needs in October 2004, degree of care needs, the first date when care needs became grade 2 or higher, the status of participation in Silver College, and date of death. Kaplan-Meier survival analysis revealed that the survival rates of the participants and non-participants at the end of the trial were 90% and 67%, respectively. Cox's proportional hazards regression model showed that adjusted hazard ratios for age were 1.125 (95% CI: 1.111-1.139) in all subjects, 1.115 (95% CI: 1.095-1.136) in males, and 1.138 (95% CI: 1.117-1.158) in females. Adjusted hazard ratios for participation in health education classes were 0.270 (95% CI: 0.172-0.423) in all subjects, 0.423 (95% CI: 0.228-0.787) in males, and 0.215 (95% CI: 0.112-0.412) in females. Long-term comprehensive health education classes for middle-aged to elderly people including lifestyle, exercise, diet, and hot spa bathing, even if conducted biweekly, may be effective in the prevention of long-term care needs.

Keywords: comprehensive health education, prevention of long-term care needs, mortality

1. Introduction

In recent years, Japan has become a fast-graying population with the highest longevity in the world. According to the statistics of the Japanese Health, Labor, and Welfare Ministry, the proportion of the elderly aged 65 years or older reached 19.1% in fiscal 2003, and is estimated that is will reach 26.0% in fiscal 2015, at which point the elderly will account for 1 in every 5 individuals.

In fiscal 2002, total national medical expenditures were approximately 262 billion dollars, while the national revenue of Japan was approximately 3 trillion 50 billion dollars. This data reveals that
2002 national medical expenditures totaled 8.58% of national revenue, and has been increasing every year. When national medical expenditures are divided into two, one for age "65 years or older" and the other for "younger than 65 years," the cost of the former amounts to 128 billion dollars (5,428 dollars per capita per year) while the cost for the latter was 133 billion dollars (1,285 dollars per capita per year). This indicates that overall medical expenditures for the elderly are extremely high in Japan. According to records for April 2004, the number of beneficiaries of public care insurance was approximately 3 million 140 thousand at a cost of approximately 46 billion dollars. Since the current care insurance system may go bankrupt without revision, the establishment of a "prevention-oriented (care prevention) system" was suggested in the revised care insurance system implemented in April 2006.

Many papers have been published that indicate the necessity of physical activity for the elderly. The American College of Sports Medicine and the American Heart Association (Haskell, et al.) have proposed that older adults should have a plan for engaging in sufficient physical exercise to address each recommended type of activity. Blair, et al., examined physical fitness and the risk of all-cause and cause-specific mortality in 10,224 men and 3120 women who were given a preventive medical examination (average follow-up period of 8 years). Higher levels of physical fitness appear to delay all-cause mortality primarily due to the resulting lowered rates of cardiovascular disease and cancer. Christmas, et al., reported that activity and exercise improved health status, muscle strength, aerobic capacity, and reduced the risk of fracture. Rajeski, et al., suggested that physical activity improved quality of life in older adults, while Peri, et al., reported that a daily program of repetitive activities of daily living improved health status in the short term in a group of frail older individuals in a residential care facility. However, few papers have examined whether a long-term program consisting mainly of exercise is effective in preventing care or mortality in the elderly.

This study aimed to investigate how participation in care-preventive education classes introduced in May 1994 affected the maintenance of independent living, care needs, and 10-year (125-month) mortality rate in a Japanese village.

2. Methods

2.1. Setting and Subjects

Yoshida Village (population, 2,450; proportion of the elderly, 31%; currently Unnan City after merger) in Unnan City, Shimane Prefecture, Japan, is a farming community. According to a report by Shimane Prefecture, both average life expectancy and healthy life expectancy (the average period of independent living) were above the prefectural norm. Specifically, the average period of independent living at 75 years of age was ranked first in the prefecture for both genders. Though the average medical expenditure for the elderly came to 5,699 dollars per person in Shimane Prefecture in fiscal 2002, it was as low as 3,888 dollars in the former Yoshida Village. It is important to elucidate the factors contributing to the maintenance of independent living among a healthy elderly population that has participated in advanced care prevention projects since 1994.

A survey of the care needs and status of participation in health education classes (Silver College) in the village was conducted among all residents (n = 1015) aged 58 or older in May 1994 with follow-up until October 2004. The age of subjects was determined based on the age qualification for participation in Silver College. Of a total of 1015 subjects, 1013 were analyzed after two people were excluded due to the fact that the time when their care needs were first recognized could not be determined.

The survey covered gender, birth date and care needs in October 2004 (125 months or 10 years and 5 months later), degree of care needs, the first date when the level of care needs reached two or higher, the status of participation in Silver College, and date of death. Two public health nurses from the public office of the village surveyed relevant documents.

2.2. Interventions (Silver College)

Silver College, which was established as part of a project for village care prevention, has operated under the Social Welfare Corporation Yoshida. For all residents in the village, the project has been promoted with the philosophy "Despite old age, try not only to lead independent living but also to become a product member of the community."

Daily activities at Silver College are shown in...
Table 1. Major annual activities consist of a total of 24 events: orientation and the setting of individual goals at the beginning of every fiscal year, four exercise sessions to prevent falling, four indoor sports sessions, five water exercise sessions, three rhythmic exercise sessions, two walking sessions, one session for the measurement of movement, and four sessions for diet instruction.

At the orientation each year, the director explains the philosophy and objectives of Silver College and the importance of self-awareness to enhance the motivation of the elderly participants and clarify common objectives. In addition, free health consultation is available, and participants convey the written opinions of their physicians to public health nurses, examine exercise content with district exercise instructors, and set individual goals.

Tea parties are held with the goal of deepening friendships in a relaxed atmosphere. In the main program, two volunteer exercise instructors offer enjoyable exercises suitable for the elderly at each session. The majority of participants also enjoy a simple thermal spa at each session to reduce and prevent pain in the locomotorium such as in the knees and lumbar spine. The College provides these intermittent interventions throughout the year.

The project was approved by the ethical committee of the College in May 2005, and by the "Committee for the Protection of Individual Information" of Unnan City in April 2005. Personal information such as names, addresses, and telephone numbers were deleted from the data obtained from Unnan City, and individual names were not identifiable. Analyses were carried out on personal computers not connected to outside sources via the Internet to maintain privacy. There were no adverse events among the class participants.

2.3. Statistical Analysis

For individuals who expired before care needs were recognized, the date of death was determined as the day when recognition occurred. Only the year when care needs were recognized was recorded, and when the month was not identified, the month of December was adopted. On the other hand, if the first date when care needs were recognized was unknown, the subjects were excluded (two persons).

The follow-up period was from May 1994, when Silver College first opened, until the date when grade 2 care needs were recognized, the date of death, or the end of the follow-up (October 2004; endpoint).

A two-sample t-test was employed for comparisons between groups with continuous variables in the analyses. Groups were compared for the first event from the start of intervention using the Kaplan-Meier survival analysis. Cox's proportional hazards regression model was used to calculate the hazard ratio, adjusting for the role of possible confounding variables (age). The SPSS® 11.0J for Windows was used for statistical analyses.

3. Results

Tables 2 and 3 show the average age and age distribution at the beginning of the follow-up in May 1994, when Silver College first opened. For both genders, the average age was significantly higher among participants in Silver College classes than among non-participants.

Figure 1 shows overall survival curves in both genders. At the end of the trial, survival rates of the participants and non-participants were 90% and 67%, respectively. In males, those rates started to decrease five years after the beginning of follow-up, and the difference between the
Table 3  Age composition of participants* at baseline

<table>
<thead>
<tr>
<th>Age group (y.)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants</td>
<td>Non-participants</td>
</tr>
<tr>
<td>&lt;65</td>
<td>1 (2.4)</td>
<td>87 (45.2)</td>
</tr>
<tr>
<td>65-74</td>
<td>25 (59.5)</td>
<td>146 (35.3)</td>
</tr>
<tr>
<td>75-84</td>
<td>15 (35.7)</td>
<td>60 (14.4)</td>
</tr>
<tr>
<td>85≤</td>
<td>2 (4.1)</td>
<td>21 (5.1)</td>
</tr>
<tr>
<td>Total</td>
<td>42 (100)</td>
<td>414 (100)</td>
</tr>
</tbody>
</table>

*participants of Silver College

Figure 1  Time to first event (total)
Ordinate shows rate of those not recognized as expired or having grade 2 care needs or more.

Figure 2  Time to first event (males)
Ordinate shows rate of those not recognized as expired or having grade 2 care needs or more.

Figure 3  Time to first event (females)
Ordinate shows rate of those not recognized as expired or having grade 2 care needs or more.

two groups narrowed 10 years later (Figure 2), in females, at the endpoint they remained high (Figure 3). Survival rates of participants were usually high, whereas those of non-participants were low. Cox’s proportional hazards regression model revealed that adjusted hazard ratios as to age were 1.125 (95% CI: 1.111-1.139) for all subjects; 1.115 (95% CI: 1.095-1.136) for males, and 1.138 (95% CI: 1.117-1.158) for females (Table 4). Adjusted hazard ratios as to participation in the class were 0.270 (95% CI: 0.172-0.423) for all subjects; 0.423 (95% CI: 0.228-0.787) for males, and 0.215 (95% CI: 0.112-0.412) for females.

4. Discussion

The care prevention project had been ongoing since 1994 in the former Yoshida Village, prior to the government’s proposal. It involves comprehensive health education, including lifestyle and exercise instructions, spa bathing, and emotional support
to make life more meaningful. The class is held only once every two weeks, but has continued for
Table 4  Results by Cox's proportional hazards regression model

<table>
<thead>
<tr>
<th>Total</th>
<th>Variables</th>
<th>Hazard ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.125</td>
<td>1.111-1.139</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Participation</td>
<td>0.270</td>
<td>0.172-0.423</td>
</tr>
<tr>
<td>Male</td>
<td>Age</td>
<td>1.115</td>
<td>1.095-1.136</td>
</tr>
<tr>
<td>Female</td>
<td>Participation</td>
<td>0.423</td>
<td>0.228-0.787</td>
</tr>
<tr>
<td>Female</td>
<td>Age</td>
<td>1.138</td>
<td>1.117-1.158</td>
</tr>
<tr>
<td>Female</td>
<td>Participation</td>
<td>0.215</td>
<td>0.112-0.412</td>
</tr>
</tbody>
</table>

An extended period. The project has welcomed the participation of 18.8% of the village community (190 people), and we showed that such has contributed significantly to the prevention of care need and death, independently of gender and age.

Iwasaki, et al., reported that males living in urban areas who did not attend meetings involving hobbies, club activities, or community groups had a significantly higher mortality rate. Tsuji, et al., reported in a large-scale four-year prospective cohort study that medical expenditures were significantly lower in those who walked one hour or longer each day than in those who did not. Kuriyama, et al., showed in a seven-year prospective cohort study that combinations of "smoking habits," "obesity (BMI 25 or higher)," and "low activity levels (walking less than one hour per day)" adversely influenced medical expenditures, i.e., medical care was most expensive among those who were positive for the above three markers, and higher in those who were positive for two than in those who were negative for the same markers. These results suggest the importance of comprehensive health instruction to inform people of the need to refrain from smoking, maintain a healthy diet and engage in physical activities and exercise.

The frequency of the interventions in the present study was as low as once every two weeks. Kamioka, et al., examined health improvements in 3-month and 6-month groups of middle-aged and elderly females attending 2-hour comprehensive health classes once per week (instruction on lifestyle and exercise and spa bathing for 1 hour each). A significant benefit was observed immediately after the intervention ended in both groups; however, the benefit tended to diminish after a six-month follow-up, and was even more diminished following a short 3-month intervention. In this study, despite a low frequency, a long-term intervention of 10 years or more seemed to alter lifestyles.

A high-frequency intervention study with elderly subjects revealed that a 2-hour exercise regimen of predominantly resistance and endurance training twice per week for 25 weeks significantly improved VO$_{2\text{max}}$. Furthermore, another report found that a 2-hour physical training program twice per week improved not only physical power but also the activity level in daily life.

A recent systematic review reported on randomized controlled trials to reveal that spa bathing could significantly reduce locomotorium pain. In this study, in addition to lifestyle and exercise instruction, aquatic exercise using spas and spa bathing were incorporated, which are presumed to contribute to both the maintenance of the activity of daily life (ADL) and quality of life (QOL).

Iwai, et al., reported that physical activity was influenced by socio-environmental factors, and that it was accompanied by other healthy behaviors. In the present study, no information on education level, lifestyle, BMI, or the presence or absence of smoking habits was available, and a great limitation was the fact that discussion was virtually impossible, given the confounding factors. Previous studies have reported that elderly individuals with low body weight (BMI < 20) showed high all-cause mortality even after adjusting for smoking habits in both genders. Anzai, et al., suggested that the relationship between healthy practices and education levels was weaker in Japan than in Europe or the USA. In the present study, however, the education levels in the two groups were unknown, leaving unclear whether or not they were confounding factors.

Several methodological limitations affect the interpretation of our findings. First, we could obtain only age and sex data for our baseline, while other possible confounding factors such as BMI, medical history, morbidity, smoking status, etc. could not be put into the Cox's proportional hazards regression model. This makes it difficult to determine the effects of the repetition of comprehensive health education. Secondly, it is probable that this study had a selection bias because of the population in a particular village. Thirdly, the change in national criterion for care need makes it impossible to expect our data to determine the same health status. Fourthly, since no class attendance records were kept, we could not conduct a subgroup analysis. More rigorous cohort studies and randomized controlled trials seem warranted.
In conclusion, repeated comprehensive health education classes including lifestyle, exercise, diet, and spa bathing, although available only biweekly, may be effective in the care prevention of middle-aged and elderly individuals.

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• Effectiveness of comprehensive health education combining hot spa bathing and lifestyle education in middle-aged and elderly women: one-year follow-up on randomized controlled trial of three- and six-month interventions. J Epidemiol, 16: 35-44, 2006
• A systematic review of randomized controlled trials of exercise and lifestyle intervention for the health promotion of older adults: Issues and an effective model of intervention. Jpn J Geriatrics, 44: 403-414, 2007

Membership in Learned Societies:
• Japan Epidemiological Association
• Japanese Association of Geriatrics
• Japan Society of Physical Education, Health and Sports Sciences
• Japanese Society of Public Health
• Japanese Association of School Health
• Japanese Society of Balneology, Climatology and Physical Medicine

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