

# Effects of a Stress Management Program Based on Psychological Risk Factors of Cardiovascular Disease after Retirement in an Underpopulated Area: A Pilot Study

Susumu Fukita<sup>1\*</sup>, Hiromi Kawasaki<sup>2</sup>, Satoko Yamasaki<sup>2</sup>

<sup>1</sup>Faculty of Nursing and Medical Care, Keio University, Kanagawa, Japan

<sup>2</sup>Graduate School of Biomedical & Health Sciences, Hiroshima University, Hiroshima, Japan

Email: \*susumu05@sfc.keio.ac.jp

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## Abstract

**Background:** To develop an effective health education program to prevent cardiovascular disease in middle-aged residents after retirement in underpopulated areas, we explored the effects of a stress management program based on the type A behavior pattern. **Methods:** This study was carried out in a rural city in Japan recognized as underpopulated and participants were civil servants aged 45 - 64 who joined a stress management program offered as part of staff training. Learning materials for the program were developed based on the type A behavior pattern. Measures for the impact evaluation were Bloom's learning domains and stage of change for stress management practice. Measures for the outcome evaluation were KG's Daily Life Questionnaire (KG Questionnaire), the Hospital Anxiety and Depression Scale (HADS) and the Framingham 10-year cardiovascular risk score (CVD risk score). We statistically analyzed changes in each item between time points. **Results:** Eighteen participants completed questionnaire surveys at pre-, post-, and 4 weeks post-program and eleven had complete blood pressure and weight measurements at pre- and post-program. In the impact evaluation, the Friedman test found significant differences between the three time points in all of Bloom's learning domain scores and stage of change for stress management. In the post hoc analysis, a significant increase was seen between pre- and post-program and between pre- and 4 weeks post-program in cognitive domain score, psychomotor domain score and stage of change for stress management. In the outcome evaluation, a significant decrease in systolic blood pressure was seen between pre- and post-program. **Conclusion:** The present study suggested that a stress management program using learning

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materials based on type A behavior could promote stress management practices and reduce the risk of cardiovascular disease. This stress management program is expected to be useful as a health promotion activity for middle-aged residents after retirement in underpopulated areas.

## Keywords

Stress Management Program, Prevention of Cardiovascular Disease, Health Promotion for Middle-Aged Residents, Rural Area, Collaboration between Community Health and Industrial Health

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## 1. Introduction

Many rural areas are facing problems such as a decline in productive function and lack of social infrastructure (e.g., medical, educational and transportation systems) because of depopulation. In Japan, 47% of all cities are recognized as underpopulated by Japanese law [1].

There is a need not only for public support, but also social activity among community dwelling people to maintain community function in underpopulated rural areas. It is expected that relatively young residents who stay in their community after retirement will play active roles in community activities such as residents' associations. In order to take on such roles, residents must retire and start community life without disease and health risks. However, it is difficult for middle-aged residents to take care of their health and practice health behaviors because of busy jobs, daily housework and other obligations. In addition, health promotion activities for the middle aged are conducted by industrial health organizations in Japan. There are not enough health promotion activities in small companies in underpopulated areas because a hygiene committee and the position of hygiene manager are not required in businesses with less than 50 employees. Thus, it is possible that the risk for retiring with disease or health risks is higher among middle-aged residents in underpopulated areas.

Particularly, the incidence of cardiovascular disease begins to increase from middle age [2] [3] and it can result in death [4] or the need for long-term care [5]. There is a greater risk in underpopulated areas where emergency medical systems or transportation systems are limited because it takes longer to receive proper medical care from a medical specialist. It is important for middle-aged residents to practice health behaviors and reduce their risk of cardiovascular disease. Effective support programs promoting health behavior and aiming to reduce the risk of cardiovascular disease after retirement in underpopulated areas are needed. If we could introduce an effective program to promote health behavior and prevent cardiovascular disease, it would contribute to middle-aged residents starting a healthy community life after retirement, which may in turn encourage them to take active roles in their community.

Psychological factors are risk factors of cardiovascular disease, and it is thought that the nervous system, endocrine system and immune system are pathways [6]. A previous study clarified that stress is one risk factor for cardiovascular disease in Japan [7]. Many middle-aged residents in Japan suffer stress and mental disorders [5]. It is important for residents in underpopulated areas to practice self-care related to stress management because there are not enough mental health clinics and psychiatric specialists in these areas. Consequently, stress management programs based on the psychological risk factors of cardiovascular disease are thought to be effective in preventing cardiovascular disease and promoting mental health at the same time in underpopulated areas.

One of the psychological risk factors of cardiovascular disease is the type A behavior pattern [8]. The type A behavior pattern consists of enhanced aggressiveness, ambitiousness, competitive drive and a chronic sense of time urgency [8]. It is thought that a type A behavior pattern leads to cardiovascular disease because the characteristics of type A behavior easily cause a stress response. We can understand the relationship between psychological factors and cardiovascular disease through the type A behavior pattern. We can also learn about many types of stress management skills through type A behavior. Various types of stress management skills, such as behavioral therapy and cognitive therapy, have been used to modify type A behavior [9]. It is said that effective stress management programs include various types of stress management skills [10]. Thus, we think that the type A behavior pattern can be used to develop useful learning materials for stress management programs to prevent cardiovascular disease. Previous study revealed effects of a intervention based on cognitive-behavioral therapies for reduction in the type A behavior pattern and cumulative cardiac recurrence rate in postmyocardial infarction patients [11]. Another previous study showed effects of a program for psychological and behavioral factors related to cardiovascular disease [12]. However, there is few studies which explore effects of a stress management program using learning materials based on the type A behavior pattern for behavioral change for stress management and reduction in risk of cardiovascular disease at the same time in healthy middle-aged residents in underpopulated area.

To identify the effects of behavior change for stress management and the prevention of cardiovascular disease, we carried out a stress management program based on the type A behavior pattern for middle-aged residents in an underpopulated area in Japan.

## 2. Purpose

The aim of this pilot study was to explore the effects of a stress management program using learning materials based on the type A behavior pattern to prevent cardiovascular disease, and to consider the feasibility of prevention activities for cardiovascular disease in middle-aged residents after retirement in an underpopulated area in Japan.

### 3. Methods

#### 3.1. Participants

This study was conducted in a rural city recognized as underpopulated by the Japanese “Act on Special Measures for Promotion for Independence for Underpopulated Areas”. Participants were civil servants aged 45 - 64 who joined a stress management program that was offered as part of staff training at a single organization. All civil servants at single organization were invited to a stress management program. The selection criteria were 1) to be 45 - 64 age, 2) to hope to join a stress management program and 3) to have no health problem to join a stress management program.

#### 3.2. Stress Management Program

The stress management program consisted of 1-hour sessions held once a week for 3 weeks. Each session consisted of a lecture, practical training and homework. Lecture topics included theory of stress (stress model [10] and salutogenesis [13]) and the relationship between psychological factors and cardiovascular disease. Practical training included relaxation skills (deep breathing [14] and anxiety management training [15]), cognitive restructuring (rational-emotive therapy [10]), self-monitoring for the type A behavior pattern and social skills to promote good communication with colleagues and family members. Homework included practicing stress management skills learned in the session (i.e., deep breathing and self-monitoring for the type A behavior pattern), recording one occasion of type A behavior and a positive diary [16] to prepare for the next session.

#### 3.3. Measures

Questionnaire surveys were administered at three time points: pre-, post- and 4 weeks post-program. Blood pressure and weight were measured pre- and post-program. Measures for the impact evaluation were Bloom’s three learning domains (cognitive, affective and psychomotor) [17] [18] and stage of change for stress management practice. Measures for the outcome evaluation were the type A behavior pattern, depression and anxiety score, and risk of cardiovascular disease.

Bloom’s three learning domains were developed to serve as a framework for establishing types and levels of assessment [17]. Bloom’s three learning domains were measured with an original questionnaire developed by the researcher that evaluates cognitive domain (five items), affective domain (four items) and psychomotor domain (two items). All 11 items were measured on 4-point scale. Example items in each domain are as follows: “Do you know the mechanism by which psychological factors cause cardiovascular disease?” (cognitive domain); “Do you intend to practice stress management to prevent cardiovascular disease?” (affective domain); and “Do you have skills for stress management?”

(psychomotor domain). The scores of the cognitive, affective and psychomotor domains range from 5 - 20, 4 - 16, and 2 - 8, respectively. Higher scores indicate a higher position in each of the learning domains.

To determine the stage of change for stress management practices, participants were asked the following question, “Do you intend to practice stress management in your daily life?” This question was used based on a previous study [19]. Participants selected their response from the following five options: 1) “Precontemplation” (not intending to begin), 2) “Contemplation” (intending to begin in the next 6 months), 3) “Preparation” (intending to begin in the next 30 days), 4) “Action” (practicing the behavior, but for less than 6 months) or 5) “Maintenance” (practicing the behavior for at least 6 months).

To assess the type A behavior pattern, KG’s Daily Life Questionnaire (KG Questionnaire) [20] was used. It consists of 55 items (44 type A behavior pattern items and 11 irrelevant or “dummy” items) scored from 0 (“No”) to 2 (“Yes”). The range of the type A score is 0 - 88 points. The KG Questionnaire has three subscales: Aggression-Hostility (AH), consisting of 18 items ranging from 0 - 36 points; Hard-driving-Time urgency (HT), consisting of 16 items ranging from 0 - 32 points; and Speed-Power (SP), consisting of 15 items ranging from 0 - 30 points. Higher scores indicate a greater tendency to exhibit the type A behavior pattern.

To assess anxiety and depression, the Hospital Anxiety and Depression Scale (HADS) [21] [22] was used. HADS is a widely used questionnaire in the general population and in hospital settings to assess anxiety (seven items) and depression (seven items) [23]. Each of the 14 items is scored from 0 (not present) to 3 (maximally present). The range of each subscale is from 0 - 21. Higher scores indicate a higher degree of anxiety and depression.

CVD risk was determined using the Framingham 10-year cardiovascular risk score (CVD risk score), which estimates the 10-year absolute risk of CVD [24]. It is calculated from gender, age, body mass index (BMI), systolic blood pressure, antihypertensive medication use, current smoking and diabetes status. The data required to build the CVD risk score were collected by public health nurses (weight and blood pressure) or by questionnaires (antihypertensive medication use, current smoking and diabetes status). Higher scores indicate a higher CVD risk.

### 3.4. Statistical Analysis

We used all data collected in the pre-, post- and 4 weeks post-program surveys. We also used all data collected for CVD risk score, BMI and systolic blood pressure, which were measured pre- and post-program.

We conducted a Friedman test to compare Bloom’s three learning domain scores, stage of change for stress management practice, KG Questionnaire score and HADS score at pre-, post- and 4 weeks post-program. We then conducted post hoc analysis with Wilcoxon signed-rank tests with a Bonferroni correction

if the Friedman test was significant, resulting in a significance level set at  $p < 0.017$ . We used Wilcoxon signed-rank tests to compare CDV risk score, BMI and systolic blood pressure pre- and post-program. P-values of less than 0.05 were accepted as significant for the Friedman test and Wilcoxon signed-rank test. We used SPSS version 24 for all statistical processing.

### 3.5. Ethical Considerations

The stress management program was carried out as part of staff training for civil servants. We received and analyzed data that were obtained from the stress management program, but the data did not include information that could identify individual participants. All participants were notified that they could opt out of this study. This study was approved by the ethical committee of the researcher's institute (approval number E-842).

## 4. Results

### 4.1. Participants

**Table 1** shows the characteristics of the participants. Eighteen participants completed the pre-, post- and 4 weeks post-program questionnaire surveys. The mean age of these 18 participants was 50.8 ( $\pm 4.3$ ) years and 55.6% were female. The proportion of participants living alone was 11.1%. The number of times

**Table 1.** The characteristics of the participants.

	Participants who completed the pre-, post- and 4 weeks post-program questionnaire surveys (N = 18)	Participants who completed blood pressure and weight measurements (N = 11)
Age, Years, M (SD)	50.8 ( $\pm 4.3$ )	51.6 ( $\pm 4.2$ )
Gender, N (%)		
Female	10 (55.6%)	7 (63.6%)
Male	8 (44.4%)	4 (36.4%)
Family structure, N (%)		
Living alone	2 (11.1%)	1 ( 9.1% )
Couple	1 ( 5.5% )	2 (18.2%)
Couple and Child(s)	9 (50.0%)	5 (45.5%)
Living other generation(s)	3 (16.7%)	2 (18.2%)
Others	3 (16.7%)	1 ( 9.0% )
Number of times participating in the program, N (%)		
One	5 (27.8%)	0 ( 0.0% )
Two	4 (22.2%)	2 (18.2%)
Three	9 (50.0%)	9 (81.8%)

participating in the program were one (27.8%), two (22.2%) and three (50.0%). Eleven participants had complete blood pressure and weight measurements. The mean age of these 11 participants was 51.6 ( $\pm 4.2$ ) years, 63.6% were female. The proportion of participants living alone was 9.1%. The number of times participating in the program were one (0%), two (18.2%) and three (81.8%).

## 4.2. Impact Evaluation

The Friedman test found significant differences between the three time points in cognitive domain score (6.44, 12.50, 12.89,  $p < 0.001$ ), affective domain score (11.28, 12.56, 12.06,  $p = 0.019$ ), psychomotor domain score (3.61, 5.22, 5.06,  $p = 0.001$ ) and stage of change for stress management (1.67, 2.61, 2.39,  $p = 0.001$ ) (**Table 2**). That stage of change for stress management was more than “action” was 5.5% (pre-program), 22.3% (post-program) and 33.3% (4 weeks post-program) (**Table 3**). In the post hoc analysis with the Wilcoxon signed-rank test, a significant increase was seen between pre- and post-program and between pre- and 4 weeks post-program in cognitive domain score, psychomotor domain score and stage of change for stress management. A non-significant increase was seen in affective domain score (**Table 2**).

## 4.3. Outcome Evaluation

A significant decrease in systolic blood pressure was seen between pre- and post-program (139.55, 129.18,  $p = 0.029$ ). A decrease was also seen in the CVD risk score (10.36, 9.09,  $p = 0.076$ ) and BMI between pre- and post-program (22.67, 22.68,  $p = 0.929$ ), but it was not significant (**Table 4**).

The Friedman test found no significant differences between the three time points in HADS (Anxiety: 7.72, 7.22, 7.56,  $p = 0.179$ , Depression: 7.22, 7.06, 7.33,  $p = 0.678$ ) and KG Questionnaire scores (Type A behavior pattern score: 35.44, 36.00, 35.78,  $p = 0.362$ , AH: 15.67, 16.06, 15.22,  $p = 0.374$ , HT: 12.56, 13.44, 13.83,  $p = 0.122$ , SP: 11.78, 10.89, 11.72,  $p = 0.325$ ) (**Table 5**).

**Table 2.** Impact evaluation: Comparison of Bloom’s learning domains and stage of change for stress management between pre-, post- and 4 weeks post-program.

	Pre-program			Post-program			4 weeks post-program			Friedman test (p-value)	Post hoc analysis <sup>1)</sup> (Wilcoxon signed-rank test)
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD		
Bloom’s learning domains											
Cognitive domain	6.44	5.00	2.55	12.50	13.50	3.54	12.89	13.00	2.19	<0.001	Pre- < Post-, Pre- < 4 weeks post-program
Affective domain	11.28	11.00	3.21	12.56	12.00	1.95	12.06	12.00	2.53	0.019	n.s
Psychomotor domain	3.61	4.00	1.09	5.22	5.00	1.40	5.06	5.00	1.47	0.001	Pre- < Post-, Pre- < 4 weeks post-program
Stage of change for stress management	1.67	1.00	0.91	2.61	3.00	1.20	2.39	2.00	1.42	0.001	Pre- < Post-, Pre- < 4 weeks post-program

<sup>1)</sup>Post hoc analysis with the Wilcoxon signed-rank test and a Bonferroni correction, resulting in a significance level set at  $p < 0.017$ . SD: standard deviation.

**Table 3.** Stage of change for stress management practices at pre-, post- and 4 weeks post-program.

	Pre-program		Post-program		4 weeks post-program	
	N	%	N	%	N	%
Precontemplation	10	55.6	4	22.2	7	38.9
Contemplation	5	27.8	4	22.2	4	22.2
Preparation	2	11.1	6	33.3	1	5.6
Action	1	5.5	3	16.7	5	27.8
Maintenance	0	0.0	1	5.6	1	5.5

**Table 4.** Outcome evaluation: Comparison of CVD risk score, BMI and blood pressure between pre- and post-program.

	Pre-program			Post-program			p-value <sup>1)</sup>
	Mean	Median	SD	Mean	Median	SD	
CVD risk score <sup>2)</sup>	10.36	10.00	3.72	9.09	8.00	3.30	0.076
BMI	22.67	22.90	4.08	22.68	22.85	4.02	0.929
Systolic blood pressure	139.55	143.00	19.10	129.18	132.00	12.47	0.029

<sup>1)</sup>Wilcoxon signed-rank test; <sup>2)</sup>CVD risk score was calculated from gender, age, BMI, systolic blood pressure, antihypertensive medication use, current smoking and diabetes status. BMI: body mass index; CVD risk score: cardiovascular risk score; SD: standard deviation.

**Table 5.** Outcome evaluation: Comparison of KG Questionnaire score and HADS score between pre-, post- and 4 weeks post-program.

	Pre-program			Post-program			4 weeks post-program			Friedman test (p-value)
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	
Type A behavior pattern score	35.44	34.50	9.89	36.00	34.00	11.52	35.78	34.00	12.33	0.362
AH	15.67	14.00	5.91	16.06	15.00	7.59	15.22	15.00	7.95	0.374
HT	12.56	12.50	4.27	13.44	13.00	5.54	13.83	13.00	4.89	0.122
SP	11.78	12.00	4.76	10.89	11.00	4.23	11.72	12.00	4.42	0.325
Anxiety	7.72	7.50	2.97	7.22	6.50	3.47	7.56	8.00	3.13	0.179
Depression	7.22	8.00	3.95	7.06	7.00	4.43	7.33	7.50	3.93	0.678

AH: Aggression-Hostility subscale; HADS: The Hospital Anxiety and Depression Scale; HT: Hard-driving-Time urgency subscale; KG Questionnaire: KG's Daily Life Questionnaire; SD: standard deviation; SP: Speed-Power subscale.

## 5. Discussion

The results of the impact evaluation in this pilot study showed that all scores of Bloom's three learning domains increased, and the stage of change for stress management practices advanced after the program. In addition, the outcome evaluation demonstrated that systolic blood pressure decreased after the pro-



gram.

### 5.1. Impact Evaluation

The increase in effective stress management practices was caused by an increase in cognition of cardiovascular disease and psychological factors, desire to practice stress management to prevent cardiovascular disease and skills in stress management. These results are consistent with the process of change based on the transtheoretical model [25]. This model explains that stages of change are promoted by processes such as “consciousness raising”, which means increasing knowledge about self and a problem, and “self-reevaluation”, which means assessing how one feels and thinks about oneself with respect to a problem [25]. The present study revealed that the stress management program promoted stage of change for stress management in healthy middle-aged residents. It is possible that incorporating prevention of cardiovascular disease in learning materials could promote stress management practices. Setting concrete goals of preventing cardiovascular disease could help motivate one to practice stress management even though it is difficult to feel the effects of stress management practices.

### 5.2. Outcome Evaluation

There was a significant decrease in systolic blood pressure after the program, but there were no significant changes in the CVD risk score, BMI, HADS score or KG Questionnaire score in the outcome evaluation. Stress responses are divided into physical, psychological and behavioral responses [26]. It was assumed that this stress management program affected physical responses such as systolic blood pressure, but did not affect psychological responses such as anxiety or depression. Because mental stress arouses the automatic nervous system and has an effect on blood pressure [27], it can be presumed that the stress management program affected blood pressure quickly. High blood pressure is a significant risk factor for cardiovascular disease [28], so it is important to prevent high blood pressure.

On the other hand, there were no significant changes in psychological responses at 4 weeks post-program. Mental disorders—depression and anxiety—are caused by continuous imbalance in the endocrine system due to chronic mental stress [29]. In addition, it is thought that it would take more time to notice effects on psychological responses because the stage of change gradually progressed after the program. Therefore, it is necessary to evaluate psychological responses over the long term.

### 5.3. Program Feasibility in Underpopulated Areas

The results of this pilot study indicated that the stress management program using learning materials based on the type A behavior pattern promoted stress management practices and reduced the risk of cardiovascular disease in middle-aged residents in an underpopulated area. This stress management program

could be used for health promotion activities for middle-aged residents after retirement in underpopulated areas. For example, this stress management program could be carried out as a health promotion activity for employees by public health nurses who belong to public offices cooperating with organizations in the industrial health field. Many residents in rural areas work for small companies that do not conduct enough health promotion activities compared with larger companies [30]. Therefore, employees who work at small companies might not receive enough support to maintain their health in the middle-age period, and they may be at greater risk for disease when they retire and start community life. In order to improve these circumstances, it is important for public health nurses to offer health promotion practices for middle-aged residents in cooperation with the industrial health field.

#### **5.4. Limitations**

There are some limitations of this study. First, the number of participants was low. Second, the study had a single arm before-after design. Third, the number of times participating in the program differed between participants. Although a previous epidemiological study revealed that stress is one risk factor of cardiovascular disease [7], few studies have investigated the effects of stress management on the prevention of cardiovascular disease in healthy middle-aged individuals. It is significant that this study indicated that the stress management program that was developed using the type A behavior pattern as learning materials could promote stress management practices and reduce the risk of cardiovascular disease. In a future study, we plan to confirm the effects of the stress management program using a control group comparison and with a larger number of participants. Further, we have to adjust for the influence of the number of times participating in the program on the effectiveness of the program using statistical methods.

#### **6. Conclusion**

This pilot study explored the effects of a stress management program using the type A behavior pattern as learning materials for the prevention of cardiovascular disease in middle-aged residents after retirement in an underpopulated area. The results indicated that the stress management program promoted stress management practices and reduced the risk of cardiovascular disease. The effects of the stress management program should be confirmed in a future study with a strict study design. This stress management program is expected to be useful as a health promotion activity for middle-aged residents after retirement in underpopulated areas.

#### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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