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Original article

No Improvement in Metabolic Health Condition of 40–74-year-old Rural Residents One Year After Screening

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Abstract

Objective: Japan introduced a new metabolic syndrome (MetS) screening and intervention program. However, the specific benefits of the program have not yet been identified. The aim of our study was to highlight the role of the program in reducing risks related to MetS in a Japanese rural area.
Methods: We used data from a prospective observational cohort study of all users who underwent an annual health checkup at a public clinic in a rural area. The subjects of the present study were all users aged 40–74 years who participated in the MetS program between January and September 2010. We ultimately analyzed a total of 413 subjects followed up 12 months after enrolment. The subjects were divided into two groups based on the need for educational support: support and non-support. In each group, we compared the subjects' MetS conditions at baseline and 12 months later.
Results: Thus, 88 subjects out of 413 were assigned to the support group. Among the support group subjects, there were no significant changes in glycemic metabolism, lipid metabolism, blood pressure and accumulation of visceral fat between the baseline and follow-up checkups. Among the non-support group subjects, there were no significant changes in glycemic metabolism, lipid metabolism and blood pressure between the baseline and follow-up checkups, but there were significant changes for the worse in accumulation of visceral fat with time.
Conclusion: Unfortunately, the metabolic conditions of the rural subjects who participated in a new MetS screening and intervention program did not improve with time. Our findings underscore the importance of developing educational intervention programs to encourage the general population to modify their lifestyle and acquire healthier habits.

Key words: metabolic syndrome, rural area, health education, health checkup, *Tokutei Kenshin*

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Introduction

Metabolic syndrome (MetS) is a lifestyle-related disease that has become a growing concern worldwide[1]. It is characterized by excess accumulation of visceral fat and closely associated with the onset of hyperglycemia, dyslipidemia or hypertension[2]. MetS is predominantly caused by unhealthy lifestyle habits including lack of physical exercise, overeating, alcohol consumption and smoking[3]. Acknowledging the growing burden of lifestyle-related diseases, the World Health Organization recommended the development of a global strategy on diet, physical activity and health[4].

Preventing MetS is an important health-related issue in Japan and other countries. In April of 2008, Japan introduced a new Mets screening and intervention program (*Tokutei Kenshin*, in Japanese) specifically targeting individuals aged 40 to 74 years of age[5, 6]. This program aims to prevent and reduce MetS in individuals at risk of lifestyle-related diseases through early screening and interventions such as counseling by medical doctors, community health nurses, or qualified dieticians

Although Fujii *et al.*[7] and Ryo *et al.*[8] reported that lifestyle intervention programs help reduce the risks related to MetS in Japanese community settings, the specific benefits of the *Tokutei Kenshin* have not yet been well identified. The impact of such initiatives is especially difficult to gauge in rural areas due to lack of data. There may also be important differences in rural and urban lifestyle and metabolic profiles that need to be taken into consideration[9].

The aim of our study was to highlight the role of the *Tokutei Kenshin* in reducing risks related to MetS in a Japanese rural community setting, using the Kyushu-Asakura Project (KAP) dataset. Our findings may help improve community management and outcomes in rural MetS patients.

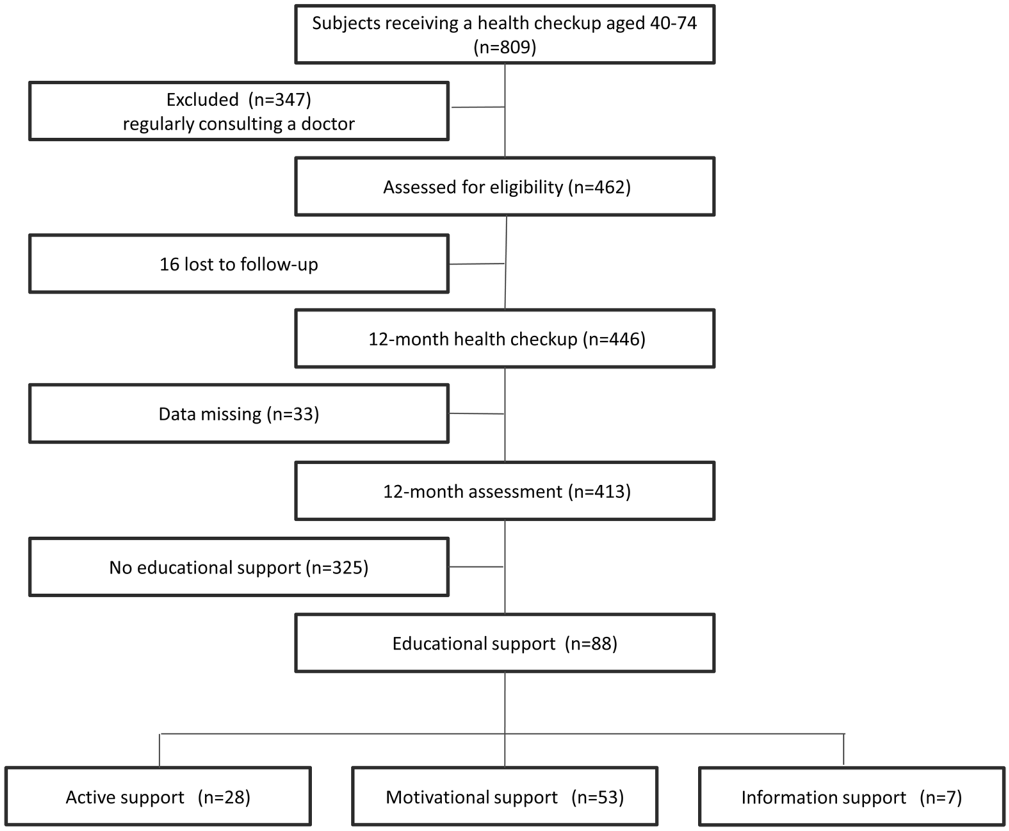

Figure 1 Flow diagram of participant recruiting and follow up.

Materials and Methods

Study population

We used data from the KAP, a prospective observational cohort study of all users who underwent an annual health checkup at a public clinic in Asakura City (Kyushu region, Western Japan) from 2009 to 2016. The test items included body measurement, blood pressure, blood test, urine analysis, chest X-ray, upper gastrointestinal tract X-ray, electrocardiogram and checkup for cancer. Asakura City is located in a typical rural area where various farm products such as wet-field rice, persimmons and long green onions are cultivated. Details of the KAP were previously published elsewhere[10, 11]. The subjects of the present study were 809 users aged 40–74 years who underwent a *Tokutei Kenshin* checkup between January and September 2010. Of the 809 users, 347 users who underwent the test as outpatients were excluded from the present study. The clinic encouraged all subjects to receive the same checkup 12 months later, and 446 of the 462 subjects received the checkup again around 12 months later (Figure 1). The users classified as in need of motivational support on the basis of the checkup results received additional counseling by or under the supervision of medical doctors, community health nurses, or qualified dieticians outside the clinic.

Data collection

We abstracted information on age, sex, weight, height, abdominal circumference, blood pressure, body mass index (BMI), complete blood cell count or biochemical examination including uric acid, HDL or LDL cholesterol, glucose and HbA_{1C} from the KAP dataset.

The users were classified into four intervention categories according to their MetS-related results; the results assessment criteria are those outlined by the Japanese MetS standards[5, 6] (Figure 2). The users who were classified as needing active support received continuous support in the form of counseling[5, 6]. The users who were classified as needing of motivational support took part in a one-time counseling session during which counselors taught them how to recognize problems in their daily habits, and how to set and achieve goals.

Step 1	Accumulation of visceral fat
	Abdominal circumference≧85 cm for males or 90 cm for females or Abdominal circumference<85 cm for males or 90 cm for females and BMI≧25
Step 2	Judge by the following items in addition to the foregoing
	Fasting blood glucose≧110 mg/dl or HBA1C≧5.2 % and/or Triglycerides≧150 mg/dl or HDLC＜40 mg/dl and/or Systolic blood pressure≧130 mmHg or Diastolic blood pressure≧85 mmHg

Figure 2 Metabolic syndrome diagnostic criteria in Japan.

Statistical analysis

Sixteen subjects were lost to follow-up for unknown reasons, and 33 subjects whose data were missing were excluded from the present analysis. Thus, we ultimately analyzed a total of 413 subjects followed up 12 months after enrolment (Figure 1). The subjects were divided into two groups based on the need for educational support: support and non-support. In each group, we compared the subjects' MetS conditions, i.e., hyperglycemia, dyslipidemia, hypertension and accumulation of visceral fat, at baseline and 12 months later. A statistical analysis was performed using the McNemar test. A *P*-value of less than 0.05 was considered statistically significant. All statistical analyses were performed on a personal computer with the Statistical Package for the Social Sciences (SPSS) for Windows (IBM SPSS Statistics 20, Tokyo, Japan).

This study was carried out with the consent of the Nagoya University School of Medicine Ethics Committee.

Results

The baseline characteristics are shown in Table 1. Although all of the mean values of MetS-related risk factors were within the normal ranges in both males and females, more than one-fifth of the subjects were identified as having a metabolic disturbance based on the MetS diagnostic criteria; 88 subjects required intervention concerning MetS, 28 subjects required active support, 53 subjects required motivational support, and 7 subjects required general information on health promotion through resources such as leaflets (Figure 1). Thus, 88 subjects out of 413 were assigned to the support group.

The results of the follow-up assessment of the subject's metabolic risk factors made 12 months after enrolment are shown in Tables 2 and 3. Among the support group subjects, there were no significant changes in glycemic metabolism, lipid metabolism, blood pressure and accumulation of visceral fat between the baseline and follow-up checkups. Among the non-support group subjects, there were no significant changes in glycemic metabolism, lipid metabolism and blood pressure between the baseline and follow-up checkups, but there were significant changes for the worse in accumulation of visceral fat with time.

Table 1 Baseline characteristics of subjects

	Male (n=179)	Female (n=234)
	Mean ± SD	Mean ± SD
Age, year	61.5 ± 7.8	60.4 ± 8.1
Uric acid, mg/dl	5.7 ± 1.3	4.4 ± 0.9
FBG, mg/dl	97.8 ± 10.8	94.3 ± 11.9
HbA_{1C}, %	5.4 ± 0.4	5.4 ± 0.4
T-C, mg/dl	195.2 ± 31.7	209.4 ± 28.6
HDL-C, mg/dl	58 ± 14.1	66.3 ± 14.3
TG, mg/dl	116.4 ± 77.0	82.1 ± 34.9
LDL-C, mg/dl	116.7 ± 30.3	126.6 ± 26.8
SBP, mmHg	124.4 ± 14.0	117.1 ± 14.8
DBP, mmHg	75.9 ± 7.8	71.3 ± 7.6
Hight, cm	165.4 ± 6.3	153.0 ± 5.4
BW, kg	62.4 ± 8.5	52.0 ± 8.2
BMI	22.7 ± 2.6	22.1 ± 3.1
Abdominal circumference, cm	81.0 ± 6.8	77.8 ± 8.5

FBG, fasting blood glucose; HbA_{1c}, hemoglobin A1c; T-C, total cholesterol; HDL-C, high-density lipoprotein cholesterol; TG, triglycerides: LDL-C, low-density lipoprotein cholesterol; SBP, systolic blood pressure; DBP, diastolic blood pressure; BW, body weight.

Disucussion

Our study examined the effectiveness of Japan's new "*Tokutei Kenshin*" MetS screening and intervention program, which was still unclear especially in rural areas.

In general, lifestyle intervention helps improve MetS conditions. Fujii *et al.*[7] suggested that participation in lifestyle intervention programs was an important factor contributing to the reduction of risks associated with MetS in Japanese community settings. However, in the present study, we found that the metabolic condition of 40–74-year-old subjects who received a MetS-related medical checkup did not improve. A number of reasons may explain these findings. First, it is possible that the subjects had not received sufficient instruction. Second, in the previous study[7], participants were all volunteers and as such were probably more health conscious and more willing to participate than the general population (like our subjects). Third, it is possible that people in rural areas hold a more subjective view of health than those in urban areas. Although it is unclear whether receiving regular outpatient treatment or not is associated with a subjective view of health, our

Table 2 Support group subjects' metabolic risk factors at baseline and after 12 months (n=88)

	Baseline		At 12 months		*P* value
	n	(%)	n	(%)	
Diabetes risk[a]	69	(78.4)	69	(78.4)	1.000
Dyslipidemia risk[b]	16	(18.2)	16	(18.2)	1.000
Hypertension risk[c]	33	(37.5)	32	(36.4)	1.000
Accumulation of visceral fat[d]	58	(65.9)	59	(67.0)	1.000

P value was determined by McNemar test. [a] Subjects at diabetes risk were defined as those with one of the following: FBG ≥ 110 mg/dl or HbA_{1C} ≥ 5.2%. [b] Subjects at dyslipidemia risk were defined as those with one of the following: TG ≥ 150 mg/dl or HDL-C < 40 mg/dl. [c] Subjects at hypertension risk were defined as those with one of the following: SBP ≥ 130 mmHg or DBP ≥ 85 mmHg. [d] Subjects with accumulation of visceral fat were defined as those with one of the following: abdominal circumference ≥ 85 cm for males or 90 cm for females or abdominal circumference < 85 cm for males or 90 cm for females and BMI ≥ 25.

Table 3 Non-support group subjects' metabolic risk factors at baseline and after 12 months (n=325)

	Baseline		At 12 months		*P* value
	n	(%)	n	(%)	
Diabetes risk[a]	249	(76.6)	244	(75.1)	0.560
Dyslipidemia risk[b]	38	(11.7)	34	(10.5)	0.596
Hypertension risk[c]	83	(25.5)	96	(29.5)	0.112
Accumulation of visceral fat[d]	0	(0)	16	(4.9)	0.000

P value was determined by McNemar test. [a] Subjects at diabetes risk were defined as those with one of the following: FBG ≥ 110 mg/dl or HbA_{1C} ≥ 5.2%. [b] Subjects at dyslipidemia risk were defined as those with one of the following: TG ≥ 150 mg/dl or HDL-C < 40 mg/dl. [c] Subjects at hypertension risk were defined as those with one of the following: SBP ≥ 130 mmHg or DBP ≥ 85 mmHg. [d] Subjects at accumulation of visceral fat were defined as those with one of the following: abdominal circumference ≥ 85 cm for males or 90 cm for females or abdominal circumference < 85 cm for males or 90 cm for females and BMI ≥ 25.

previous study[12)] sample in the same setting suggested that nearly half of those who held a subjective view of health received regular outpatient treatment. Igarashi and Iijima[13)] suggested that mental factors such as life satisfaction and subjective stress could influence a person's subjective view of health. It is possible that the present study subjects held a strong subjective view of health due to the above-mentioned mental factors, and that they therefore had less motivation to improve their life habits. Our results suggest that we need to develop educational intervention programs designed to increase motivation toward lifestyle modification.

Several limitations of our study should be mentioned. First, the clinic provided medical screening checkups, but did not offer counseling services related to MetS. Therefore, we were unable to confirm how many subjects had actually received interventions such as counseling. Second, the conclusions of this study should not be generalized to MetS checkups because of possible selection bias. Third, although the KAP study included important baseline information on MetS, i.e., healthy habits such as food or exercise collected through a questionnaire, we were unable to include this information in our analysis because of a low response rate. Fourth, in rural areas where public means of transportation are often lacking[14)], people may opt to use a car more frequently and therefore exercise less; another factor that may discourage people from keeping fit is that sports facilities may be located too far away from their homes. Therefore, even if subjects received counseling related to MetS, they may still find it difficult to switch to healthier lifestyle habits. However, due to a lack of data on urban areas as a control group in the present study, this hypothesis could not be verified. Lastly, because the average age of our subjects was over 60, with a high number of people over the age of 65, aging definitely had a strong impact on our results.

Conclusion

Unfortunately, we found that the metabolic conditions of the 40–74-year-old rural subjects who participated in a new MetS screening and intervention program did not improve with time. The findings of the present study underscore the importance of developing educational intervention programs to encourage the general population to modify their lifestyles and acquire healthier habits.

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