Field report

Relationship between mortality risk and health-related factors and sense of coherence in residents of a rural area in Japan

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Abstract

Objective: This study aimed to examine the relationship between mortality risk and health-related factors and sense of coherence (SOC) in a cohort study of residents from a rural area of Japan.

Materials and Methods: We followed-up with 3,416 baseline respondents over 3.76 years. Residents were subdivided into three groups based on SOC score: low, middle, and high. We used the total SOC score of the low-level SOC group as the standard, and calculated the standardized mortality ratio (SMR) for the middle- and high-level SOC groups. For all three SOC groups, health-related factors were analyzed by one-way analysis of variance, and lifestyle and history were analyzed using the χ² test. Results were also analyzed by gender and age.

Results: For men in the low-level SOC group, the SMR value was defined as 1, and for men in the high-level SOC group (0.44; 95% confidence interval: 0.11–0.77), the SMR value was significantly lower. There was a statistically significant reduction in the percentage of smokers in the men in the high-level SOC group.

Conclusion: In this study, high-level SOC was associated with low mortality risk. This finding was particularly pronounced in the men.

Key words: sense of coherence, standardized mortality ratio, cohort study, mortality risk

Introduction

Sense of coherence (SOC) is a concept related to stress coping ability and the ability to maintain good health, and is a component of medical sociologist Aaron Antonovsky’s theory of salutogenesis⁵. There are three central tenets to the concept of sense of coherence: comprehensibility (the cognitive component), manageability (the instrumental component), and meaningfulness (the emotional component)⁶. Thus, SOC can be thought of as the ability to cope with stress and maintain good health.

It has been hypothesized that when an individual’s SOC increases, he or she will be able to more easily cope with stressors and is more likely to remain healthy⁷. In Europe and the United States, one cohort study⁸ reported that in groups with high-level SOC, the hazard ratio of suffering from cardiovascular disorders was significantly lower than in groups with low-level SOC; however, there has been no evidence of this in cohort studies of elderly residents in Japan.

In Japan, there has been one cross-sectional study of SOC by Takayama et al.⁹; however, there have been no longitudinal studies of a local population addressing the relationship between health-related factors and SOC.

This study aimed to examine the relationships between mortality risk and health-related factors and SOC using data derived from a cohort study of residents from rural areas of Japan.

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Materials and Methods

Participants

Ozu City is located in rural southeastern Ehime Prefecture in Japan. In 2009, the city had a population of 51,020 (24,284 men and 26,736 women). Children (infants through aged 14 years) make up 15.1% of the population, and seniors (aged 65 years and over) make up 27.9% of the population.

Baseline survey

The participants were residents of Ozu City, aged between 40 and 74 years, who had undergone medical examinations relating to metabolic syndrome. This study used a 13-item SOC questionnaire translated into Japanese by Yamaski et al.6

We carried out an original study of residents who had undergone new medical examinations for metabolic syndrome. The assessments included data from the following sources: personal information, a questionnaire on lifestyle, a questionnaire on health-related quality of life, and a 13-part questionnaire on SOC.

We created an original questionnaire to collect data on daily life and habits, including smoking and drinking, and carried out a lifestyle survey of local residents. Data on health-related factors, such as body mass index, blood pressure, serum lipid levels, and blood sugar, among others, were derived from medical examinations carried out between 2009 and 2011. The baseline survey was conducted between June 1, 2009 and November 30, 2011.

Follow-up survey

The baseline respondents underwent annual medical examinations during the period from June 1, 2009, to November 30, 2011. We followed-up with the 3,416 baseline respondents from June 1, 2009, to December 31, 2013 (average follow-up period=3.76 years), and determined whether the respondents were still living and whether they were still residents of the area or had moved.

Classification of SOC

In the Japanese version of the SOC questionnaire, there are 13 questions with scores from 1 to 7 points. Using the total SOC score, from 13 to 91 points, we classified the respondents into three groups: high-level, middle-level, and low-level. These groups were further subdivided by gender and age.

We also classified respondents based on the following three SOC subscales: meaningfulness, comprehensibility, and manageability. These classifications were also further subdivided by gender and age.

SMR calculation

To calculate standard mortality ratio (SMR) for the high-level, middle-level, and low-level SOC groups, we used the low-level SOC group as the basal population group.

Firstly, for the low-level SOC group, we calculated a basal mortality rate by dividing the number of actual deaths (N) by the observational person years (PY) for three age brackets (aged 40–64 years, 65–69 years, and 70–74 years) and for each gender.

Secondly, we calculated expected deaths using the basal mortality of the low-level SOC group multiplied by the observational person years (PY) of each of the three age brackets (aged 40–64 years, 65–69 years, and 70–74 years) for the middle- and high-level SOC groups and for each gender.

Finally, we calculated SMR by dividing the number of actual deaths (N) for the middle-level and high-level SOC groups by the expected deaths of the three age brackets (aged 40–64 years, 65–69 years, and 70–74 years) and for each gender.

The SMR value of the low-level SOC group was defined as 1, and the SMR values of the middle- and high-level SOC groups were analyzed by logistic regression analysis. For the three SOC groups (low, middle, and high), we analyzed health-related factors by one-way analysis of variance, while lifestyle and history were analyzed using a χ² test. A statistically significant difference was defined as 0.05 or less for all analyses using SPSS Version 22 (IBM Corporation, Armonk, NY, USA) software.

Ethical considerations arising from privacy issues in epidemiological studies

Our study received permission from the Faculty of Education, Ehime University’s Ethical Committee of Etiology to access the electronically stored personal information in the Basic Resident Register maintained by the local government of Ozu City. In addition, in order to use private information from medical examinations and health-related questionnaires, we obtained individual written consent as required under the Japanese Privacy Protection Law.

Ethical considerations relating to the act on the protection of personal information and access to death certificate data maintained by Ozu City

Disclosure of information from the Ozu City Basic Resident Register and access to this information as digital data stored on portable media.

To track the death of any of the 3,416 study participants, we used individual personal information obtained from the records maintained by the local government of Ozu City.

Each of the 3,416 baseline respondents provided individual written consent allowing us to access records indicating if they had moved away from Ozu City or had died.

To obtain access to the Basic Resident Register maintained by the local government of Ozu City, we submitted the individual written consent of each of the 3,416 study par-
participants. Consequently, we obtained electronically stored personal information regarding whether the study participant was still in Ozu City or had moved away (date of move) and whether or not the person was still alive or was deceased (date of death).

In addition, we obtained information from the electronic death certificate dataset maintained by the Ministry of Health, Labour and Welfare. This dataset includes the following information for all people who died while residing in Ozu City during the course of our study: gender, date of birth, date of death, and cause of death (classified by the International Classification of Diseases, 10th Revision).

Using three data points (gender, date of birth, and date of death) as common searching keys, we matched the information maintained in the Basic Resident Register of Ozu City with the death certificate dataset maintained by the Ministry of Health, to identify which of the 3,416 study participants had died during the observation period.

Permission to access death certificate data for Ozu City, maintained by the Ministry of Health, Labour and Welfare

As part of the investigation into the factors relating to SOC scores and causes of death in the residents of Ozu City aged 40 years and over, the researchers had to periodically obtain access to death certificate data maintained by the Ministry of Health, Labour and Welfare. The second author (TK) applied to the Ministry of Health, Labour and Welfare’s Bureau of Statistics for permission to access electronically stored death certificate data relating to residents of Ozu City. The Ministry of Health granted permission based on the dual requirements that the researcher, TK, was (1) the recipient of a Grant-in-Aid for Scientific Research (Category C) from the Japan Society for the Promotion of Science for both (a) project number 22590587, TK, research period 2010 to 2012, “Autonomic nerve function and cardiovascular disorders—Ozu cohort study,” and (b) project number 17K09204, TK, research period 2017 to 2021, “Relationship between SOC scores and the event of cardiovascular disorders, total death/cause-specific death—Ozu cohort study”; and (2) had research permission from Ehime University’s Ethics Committee.

Results

The respondents in this study were 3,416 residents of Ozu City (1,406 men and 2,010 women), aged 40 to 74 years, who underwent annual medical examinations between 2009 and 2011.

The study respondents were all members of the National Health Insurance system run by Ozu City.

In the 40–64 age bracket, there were 1,720 respondents (762 men, 958 women), in the 65–69 age bracket, there were 858 respondents (341 men, 517 women), and in the 70–74 age bracket, there were 874 respondents (339 men, 535 women).

In 2010, there were 10,572 people aged 40–74 years who were enrolled in the National Health Insurance system in Ozu City. In the 40–64 age bracket, there were 5,869 people (3,025 men, 2,844 women), in the 65–69 age bracket, there were 2,256 people (1,057 men, 1,199 women), and in the 70–74 age bracket, there were 2,447 people (1,082 men, 1,365 women).

Our respondents included 32.3% (3,416 respondents/10,572 people) of the people aged 40–74 years who were enrolled in the National Health Insurance system in Ozu City, 29.3% (25.2% men, 33.7% women) in the 40–64 age bracket, 38.0% (33.2% men, 43.1% women) in the 65–69 age bracket, and 35.7% (31.3% men, 39.2% women) in the 70–74 age bracket. These figures reflect the number of respondents who filled out questionnaires in full.

Table 1 shows the three SOC groups subdivided by gender and age bracket.

Table 2 shows the number of actual deaths in three SOC level groups by gender and age bracket.

Table 3 shows the three SOC subgroups separated by gender and age bracket.

The average total SOC score, and the average score of the three subgroups, increased with age for both men and women.

Table 4 shows SMR data of the three SOC subclassifications separated by gender.

For men, the SMR value of the low-level SOC group was defined as 1. The SMR value of the high-level SOC group (0.44; 95% confidence interval [CI]: 0.11–0.77) was significantly lower; however, the SMR value of the middle-level SOC group (0.58; 95% CI: 0.15–1.01) was not significantly different.

For women, the SMR value of the low-level SOC group was defined as 1. The SMR values of the middle-level SOC group (0.88; 95% CI: 0.18–1.59) and the high-level SOC group (1.19; 95% CI: 0.45–1.93) were not significantly different. In the high-level SOC subgroups, only in men were the values for meaningfulness (0.39; 95% CI: 0.05–0.74) and comprehensibility (0.60; 95% CI: 0.23–0.97) significantly lower.

Table 5 shows subject attributes (health-related factors), lifestyle, and life history subdivided by SOC group and gender.

In the men’s high-level SOC group, the percentage of smoking was significantly lower. For women, average low-density lipoprotein cholesterol was higher and the percentage of subjects with a history of hypertension was higher in the high-level SOC group than in the low-level or middle-level groups.
Discussion

Our study showed that for both men and women, total SOC scores increased with age. Results from our study support the findings of Takayama and Yamasaki et al. Traditionally, the medical paradigm has been to diagnose the cause of disease in humans, and it is thought that treatment and prevention of disease is directly connected to the health of the mind and body.

There are two types of health-maintaining factors. One...
The salutogenic model is a new concept that not only focuses on the risk factors of disease but also examines factors influencing well-being and health.

An experimental study of SOC has two perspectives; one viewpoint examines what effect different levels of SOC have on a person’s health, and the other viewpoint examines the environmental factors that influence the level of SOC. It is possible to measure the level of SOC using the SOC scale. Further, it is thought that using the SOC scale, it is possible to measure the internal ability of people to successfully cope with stressful events.

The concept of SOC is different from the traditional con-

**Table 5** Attributes (health related factors), lifestyle, and life history by sex and SOC group

| Factors                        | Category | Low level of SOC group | Middle level of SOC group | High level of SOC group | \( \chi^2 \) | P-Value | Multiple comparisons |
|--------------------------------|----------|------------------------|---------------------------|-------------------------|-------------|---------|----------------------|
| Men Attribute                  |          |                        |                           |                         |             |         |                      |
| Age                            | [years]  | 60.33 ± 9.30           | 62.88 ± 11.1              | 64.88 ± 7.48            | <0.001      | High > Middle > Low |
| Body Mass Index                | [kg/m^2] | 23.56 ± 3.21           | 23.35 ± 2.83              | 23.53 ± 3.13            | 0.527       |         |                      |
| Systolic blood pressure        | [mmHg]   | 131.39 ± 19.10         | 133.05 ± 18.53            | 133.84 ± 18.31          | 0.126       |         |                      |
| Diastolic blood pressure       | [mmHg]   | 79.84 ± 11.32          | 80.31 ± 11.22             | 79.72 ± 10.53           | 0.689       |         |                      |
| LDL-Cholesterol                | [mg/dL]  | 122.08 ± 30.61         | 121.54 ± 29.88            | 123.53 ± 28.98          | 0.562       |         |                      |
| HDL-C                          | [mg/dL]  | 56.28 ± 15.04          | 45.68 ± 13.73             | 56.20 ± 15.28           | 0.869       |         |                      |
| HbA1c                          | [%]      | 5.42 ± 0.69            | 5.38 ± 0.53               | 5.47 ± 0.73             | 0.565       |         |                      |
| Life style Smoking             |          | 308 (69.5)             | 355 (76.5)                | 396 (79.4)              | 12.730      | 0.002   |                      |
| Alcohol drinker                |          | 115 (26.0)             | 94 (20.3)                 | 127 (25.5)              | 5.076       | 0.079   |                      |
| Life history History of hypertension |          | 311 (70.2)             | 331 (71.3)                | 337 (67.5)              | 1.743       | 0.418   |                      |
| Diabetes                       |          | 415 (93.7)             | 448 (96.6)                | 469 (94.0)              | 4.620       | 0.099   |                      |
| Cardiovascular disease         |          | 429 (96.8)             | 445 (95.5)                | 470 (94.2)              | 3.798       | 0.150   |                      |
| Cancer                         |          | 439 (99.1)             | 462 (99.6)                | 496 (99.4)              | 0.812       | 0.666   |                      |
| Women Attribute                |          |                        |                           |                         |             |         |                      |
| Age                            | [years]  | 61.73 ± 8.6            | 62.92 ± 7.7               | 65.51 ± 6.8             | <0.001      | High > Middle > Low |
| Body Mass Index                | [kg/m^2] | 22.66 ± 3.48           | 22.66 ± 3.37              | 22.83 ± 3.33            | 0.570       |         |                      |
| Systolic blood pressure        | [mmHg]   | 128.84 ± 19.33         | 130.49 ± 19.65            | 130.76 ± 18.90          | 0.137       |         |                      |
| Diastolic blood pressure       | [mmHg]   | 74.71 ± 10.91          | 75.37 ± 10.87             | 75.14 ± 10.34           | 0.525       |         |                      |
| LDL-Cholesterol                | [mg/dL]  | 127.69 ± 30.51         | 132.93 ± 29.30            | 133.18 ± 30.09          | 0.001       | High, Middle > Low |
| HDL-C                          | [mg/dL]  | 64.69 ± 15.60          | 65.59 ± 15.73             | 64.20 ± 14.88           | 0.249       |         |                      |
| HbA1c                          | [%]      | 5.36 ± 0.64            | 5.42 ± 0.65               | 5.41 ± 0.54             | 0.186       |         |                      |
| Life style Smoking             |          | 642 (97.1)             | 619 (96.7)                | 694 (97.9)              | 1.788       | 0.409   |                      |
| Alcohol drinker                |          | 483 (73.1)             | 471 (73.6)                | 549 (77.4)              | 4.147       | 0.126   |                      |
| Life history History of hypertension |          | 484 (73.2)             | 478 (74.7)                | 488 (68.8)              | 6.318       | 0.042   |                      |
| Diabetes                       |          | 377 (26.8)             | 162 (25.3)                | 221 (31.2)              | 0.802       | 0.670   |                      |
| Cardiovascular disease         |          | 747 (97.9)             | 628 (98.1)                | 685 (96.6)              | 3.717       | 0.156   |                      |
| Cancer                         |          | 656 (99.2)             | 638 (99.7)                | 703 (99.2)              | 1.676       | 0.433   |                      |

1: Applicable to stroke, myocardial infarction, angina. 2: Applicable to prostate cancer, lung cancer, breast cancer, other centralized distributed. ( ): %. #: A statistically significant difference was defined as five percent or less by Kruskal-wallis Test. §: A statistically significant difference was defined as five percent or less by \( \chi^2 \) test.
cept of disease in that it suggests that disease does not arise purely from various risk factors. Instead, it proposes that disease arises when a person fails to maintain the natural factors responsible for a healthy physical state. Urakawa9) reported that people who have high levels of SOC have healthy life habits.

For men, the SMR value of the low-level SOC group was defined as 1, and the SMR value of the high-level SOC group (0.44; 95% CI: 0.11–0.77) was significantly lower. In our study, for men in particular, a high-level of SOC was associated with low mortality risk. In the men’s high-level SOC group, the percentage of smokers was also significantly lower. We have conducted two studies of the residents of Ozu City: one was a cross-sectional study that matched residents’ individual SOC questionnaire scores and health examination data and the other was a longitudinal study that matched SOC scores and incidence of death. In the future, we plan to extend the follow-up periods for the Ozu cohort study and to further analyze the relationship between mortality risk and specific health-related factors.

**Conclusion**

In our cohort study, during the 3.76 years’ follow-up period, high-level SOC was found to be associated with low mortality risk.

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