ORIGINAL ARTICLE

Relationship between Low Evaluation by Recipients under 40 years old of Health Interviews by Occupational Health Nurses and Deterioration in Health Checkup Results over One year

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Abstract: Improvement of an unhealthy lifestyle decreases the risk of incidence and mortality from lifestyle-related disease. One method for the improvement of an unhealthy lifestyle is interviewing for health and consultation regarding a healthy lifestyle to recipients of health checkups by public health nurses. Original articles in occupational health for recipients' evaluation in health checkups as longitudinal studies are rare. The purpose of the present study was to investigate in a longitudinal study the relationship between recipients' evaluation of interviews by public health nurses in a health checkup and variations in health checkup results for one year.

Data on 750 male white collar workers who underwent a company health checkup in 1999 and 2000 were analyzed. The variation in health checkup results for one year from 1999 to 2000 was studied by computing odds ratios in a conditional logistic analysis of the recipients who set a low value on the interview for health by occupational health nurses in the health checkup in 1999 and those who did not.

It was found that among the subjects who set a low value on the usefulness of the interview by the occupational health nurses, the numbers of the subjects whose body mass index (BMI) and triglyceride value (TG) were healthy (normal) in 1999 and unhealthy (abnormal) in 2000 were significantly greater than those of the subjects whose values were unhealthy in 1999 and healthy in 2000, while such a finding was not detected in the subjects who set a high value on the interview. The differences for BMI and TG between (i) differences between deterioration and improvement of health checkup results in the subjects who evaluated the interview lowly and (ii) those in the subjects who did not were statistically significant as interactions. It can be supposed that some of the subjects who set a low value on the usefulness of the interview by the occupational health nurses may be indifferent to their health status, indicating that low recipient evaluation of the interview for health in health checkup may be regarded as a risk factor of metabolic syndrome from the viewpoint of prevention. (Keio J Med 57 (2) : 90-98, June 2008)

Key words: health checkup, recipient, evaluation, interview for health, longitudinal study

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Introduction

Mortality, incidence and prevalence rates of lifestylerelated diseases (e.g. cancer and cardiovascular diseases) are recently higher in developed countries compared to fifty years ago,¹ and this is one of the major social problems that should be settled. An unhealthy lifestyle from childhood involves a major risk of incidence, prevalence, and mortality from lifestyle-related diseases,²⁻⁴ while improvement of an unhealthy lifestyle can decrease the risk.⁵⁻¹⁰ Reduction of the risk is related to the decrease in mortality, incidence and prevalence rates,⁶⁻¹¹ accompanied by improved well-being and a decrease in medical expenses.^{10,11}

To improve an unhealthy lifestyle, it is important not only to spread widely information about the reduction of the risk of lifestyle-related diseases but also to provide educational intervention to subjects in health care systems. Methods to improve an unhealthy lifestyle include interviews for health and consultations regarding a healthy lifestyle to recipients of health checkups in occupational and community health fields by public health nurses^{5,9,12} and to patients in hospitals or clinics by medical staffs.¹³ A number of reports^{12,14–17} in which recipients' satisfaction and evaluation of interviews for health and intervention in consulting regarding a healthy lifestyle were studied have been published. These reports^{12,14–17} noted that the satisfaction of the recipients was influenced by the employee's age, job type, waiting time during health checkup, burden involved in filling out a checklist, courtesy of health care staff, technical level of staff, and contents of the interview. Lifestyles of recipients after the consultation were improved¹⁷ in those cases where the recipients indicated satisfaction regarding the interviews. However, the degree of recipients' satisfaction and evaluation of the interview and the intervention varied.¹⁷ Original articles in occupational health for recipients' evaluation and satisfaction in health checkups as longitudinal studies are rare.

The authors reported that those subjects who complained of many problems in a questionnaire were apt to set a high value on the interview and intervention as a cross-sectional study.¹⁸ The objective of the present study is to investigate the variations in health checkup results for one year in the subjects who gave a low evaluation for the interview by occupational health nurses in a health checkup and those who did not. The present study is a longitudinal study on the difference in improvement and deterioration of health checkup results after the health checkup between the subjects who gave a low evaluation regarding the interview and those who did not. This makes it possible to discuss the significance of the recipients' evaluation of the interview by occupational health nurses in health checkups from the viewpoint of occupational health.

Subjects and Methods

Subjects

In October 1999 and 2000, 1,490 and 1,684 white collar workers, respectively, under the age of 40 years old employed at the headquarters of a large computer system corporation in the Tokyo area were examined for health status. In both health checkups, 798 white collar workers were examined and 796 workers responded to the questionnaire for recipient evaluation of the health interview by occupational health nurses. In the present study, data on 750 male subjects were analyzed. Female subjects were not included because their number was not sufficiently large. The number of subjects of 21-25, 26-30, 31-35, and 36-39 years old was 32, 312, 276, and 130, respectively. The mean, standard deviation, maximum and minimum of age of the male subjects in 1999 were 30.5, 3.9, 38, and 21 years old, respectively. The data in 1999 were analyzed and the results were reported as a cross-sectional study.18

The number of subjects who were examined for health status at the headquarters in 1999 but were not examined in 2000 was 692 (= 1,490-798). Most of those 692 subjects were transferred from the headquarters to other offices of the corporation.

Health checkup

Health checkup for employees must be performed every year by law in Japan. Occupational health nurses are the main providers of health services to employees including interviews for recipients of health checkups.

In the headquarters of the corporation investigated, a health checkup for employees under 40 years old is conducted every autumn,¹⁸ while a health checkup for employees over 40 including more examination items is conducted almost all year round in some health care institutions. Therefore, elder employees were not included as subjects in the present study. The health checkup includes (i) a self-administered questionnaire, (ii) blood, urine, and physical examinations, and (iii) an interview by public health nurses. Recipients reply to the questionnaire before health checkup. The questionnaire comprises 127 items divided into four categories (i.e., physical symptoms, mental symptoms, occupational environment, and daily life habits) and the number of items in the four categories is 30, 31, 32, and 34, respectively.

In the interview for health conducted by the occupational health nurses, each recipient is questioned regarding his/her health taking account of the above information obtained. The interview was conducted by ten occupational health nurses in 1999, and matching of an occupational health nurse and a recipient is not designed previously. The purposes of the interview by the occu-

pational health nurses in the health checkup are (i) to raise the recipient's own awareness of his/her health status and (ii) to screen for whether it is necessary to intervene with a consultation regarding healthy lifestyle. If the recipient wants to understand his/her health status sufficiently and the occupational health nurse determines that the recipient needs health consultation regarding lifestyle, she intervenes regarding improvement of lifestyle. The items of intervention are abstinence from smoking, drinking in moderation, exercise, and improving eating habits. The purpose of the intervention is improvement of recipients' lifestyle. However, improvement of recipients' lifestyle as a result of the intervention by occupational health nurses is not expected in the corporation. A manual on interviews for health and intervention for lifestyle by occupational health nurses does not exist at present. The occupational health nurses usually take 7-10 minutes for the interview and intervention. They take more time, at most 20 minutes, for the subjects who complain of many problems or whose examination values are unhealthy. In order to conduct the present study, an additional self-administered questionnaire¹⁸ survey regarding recipients' evaluation of the interview for health and intervention for improving lifestyle by the occupational health nurses was conducted in the health checkup of 1999. All recipients responded to the questionnaire items for health interview. The subjects who thought that they were intervened regarding lifestyle by the occupational health nurses responded to the questionnaire items regarding recipients' evaluation of the intervention. All subjects replied to the additional questionnaire right after the interview in 1999. The items of the additional questionnaire are shown in Appendix. In the questionnaire, the recipients' evaluation items for the interview and intervention by the occupational nurses were composed of the items for usefulness and understanding (Appendix).

The additional questionnaire contained the identification numbers of the subjects in the corporation, so the information from the additional questionnaire could be linked to the information from the previous self-administered questionnaire and examination data.

Statistical analyses

The data of the health checkup items (i.e., body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), blood sugar (BP), total cholesterol (T-Cho), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), aspartate aminotransferase (AST), alanine aminotransferase (ALT), γ -glutamyltranspeptitase (γ -GTP)) were statistically analyzed. All variables in the present study were used as binary variables in the computation. The data of the health checkup items were dealt with as healthy (normal) or unhealthy (abnormal).

Table 1 Unhealthy range in the health checkup data

| BMI | $25 \text{ kg/m}^2 \leq$ |
|-------|--------------------------|
| SBP | 140 mmHg ≦ |
| DBP | $90 \text{ mmHg} \leq$ |
| BS | $110 \text{ mg/dl} \leq$ |
| T-Cho | $220 \text{ mg/dl} \leq$ |
| TG | $150 \text{ mg/dl} \leq$ |
| HDL-C | 40 mg/dl > |
| AST | 41 U/l ≦ |
| ALT | 46 U/l ≦ |
| γ-GTP | 74 U/l ≦ |

| BMI: body mass index, SBP: systolic blood | d pressure, |
|--|---------------|
| DBP: diastolic blood pressure, BS: blood sugar, | <u> </u> |
| T-Cho: total cholesterol, TG: triglyceride, | |
| HDL-C: high-density lipoprotein cholesterol, | |
| AST: aspartate aminotransferase, ALT: alanine amin | otransferase, |

 γ -GTP: γ -glutamyltranspeptitase

Table 1 shows the ranges of the unhealthy values for the health checkup items. The data from the questionnaire items with four choices in the present study were also dealt with as binary data (i.e., the upper two and the lower two choices) with due consideration for qualitative difference between affirmation and negation.

Conditional logistic analysis was conducted regarding variations in the health checkup results for one year from 1999 to 2000 obtaining odds ratio with its 95% confidence interval (95% CI) and statistical test in the subjects who gave a low evaluation for the interview for health by the occupational health nurses in the health checkup and those who did not. The odds ratio in conditional logistic analysis indicates the ratio between the number of subjects whose health checkup results deteriorated for one year from 1999 to 2000 and that of improved. This odds ratio is equivalent to McNemar's odds ratio mathematically. In order to compare the odds ratio of the conditional logistic analysis of the subjects who gave a low evaluation for the interview with that of those who did not, ordinary logistic analysis calculating odds ratio with its 95% CI and statistical test was conducted using data of the subjects whose health checkup results deteriorated and improved. This odds ratio is equivalent to that of the 2X2 contingency table including the numbers of the subjects whose health checkup results deteriorated and improved according to the evaluation (low or high) mathematically. This statistical analysis is the main analysis in the present study to investigate the relationship between recipients' evaluation of the interview for health and variations in health checkup results. This odds ratio means the ratio between the two odds ratios in the conditional logistic analysis of the subjects who evaluated the interview lowly and highly, indicating an interaction. Greater odds ratio for the interaction than 1.0 indicates that the odds ratio between the number of subjects whose health checkup results deteriorated and that improved in

the subjects who lowly evaluated the interview is greater than that in the subjects who did not. This indicator was shown as an odds ratio ratio.¹⁹

The data were analyzed after establishing that each individual could not be identified. For the computation SAS Release 6.12 was used.

Results

The number of subjects who highly evaluated the usefulness (0.1, in Appendix) of the interview for health by the occupational health nurses in the health checkup was 632 and that of subjects who did not was 118. The number of subject who highly evaluated the understanding (Q.2, in Appendix) of the interview was 671 and that of subjects who did not was 75. Table 2 shows the variations in health checkup results for one year from 1999 to 2000 in all subjects (Table 2-a), the subjects who highly evaluated the usefulness of the interview (Table 2-b), and those who did not (Table 2-c) with the odds ratios in conditional logistic analysis for the variations, their 95% CIs, and statistical tests. Improvement of BS was shown (p<0.01) in all subjects and those who highly evaluated the interview. Statistical significant (p<0.05) deterioration of BMI and TG was detected in the subjects who lowly evaluated the usefulness of the interview for health by the occupational health nurses in the health checkup, but not detected in the subjects who highly evaluated.

In order to detect the differences between the two odds ratios in the conditional logistic analysis, the data on variation of the health check-up results and evaluation of the usefulness of the interview (Q.1 in Appendix) were analyzed using ordinary logistic analysis, and the results calculated from the data are shown in Table 3. The relationship in Table 3 indicates an interaction which shows the difference between (i) the difference between deterioration and improvement of health checkup results in the subjects who gave a low evaluation of the interview and (ii) that in the subjects who did not. Greater odds ratio than 1.0 in Table 3 indicates that the odds ratio between the number of subjects whose health checkup results deteriorated and that improved in the subjects who lowly evaluated the interview is greater than that in the subjects who did not. The odds ratios of BMI and TG were statistically significant (p < 0.05), while the statistical tests other than the two were not significant. Odds ratio with its 95% CI of TG for the ordinary logistic analysis was 2.62 (1.12, 6.10). Table 3 shows that the number of greater odds ratios than 1.0 is nine and that of less than 1.0 is one.

Similar statistical analyses for recipients' evaluation of understanding the interview by the occupational health nurses (Q.2 in Appendix) were conducted, but notable findings were not detected. Therefore, the statistical results are not tabulated. Notable findings were not detected from the similar statistical analyses for intervention of lifestyle (i.e., with or without the intervention (Q.a-d in Appendix) and high and low evaluation of the interventions (Q.3-10 in Appendix)). Therefore, the statistical results are not tabulated.

The relationship between the recipients' evaluation of the interview for usefulness and understanding (Q.1 and 2 in Appendix) was analyzed statistically, and a strong positive relationship was detected as odds ratio 23.21. Relationships between (i) variations (i.e., deterioration or improvement) of lifestyle (e.g. smoking, drinking, exercise, and eating) obtained from the self-administered questionnaire for one year and (ii) information on the additional questionnaire (Appendix) were also analyzed statistically, but meaningful results were not found. Therefore, the statistical results are not tabulated.

The notable differences of the health checkup results in 1999 between the subjects who were transferred from the headquarters in 1999-2000 and those who were not were not detected. Age did not significantly influence the results in the present study.

Discussion

Odds ratios of BMI and TG in conditional logistic analysis were greater than 1.0 with statistical significance (p<0.05) in the group indicating low recipient evaluation for the usefulness of the interview for health (Table 2-c), while this was not detected in the group indicating high evaluation (Table 2-b). This means that the numbers of the subjects whose BMI and TG values deteriorated for one year were significantly greater than the numbers of the subjects whose values improved in the group with low recipient evaluation, while such differences were not detected in the group with high evaluation. Odds ratios for BMI and TG in conditional logistic analysis of the subjects who lowly evaluated the usefulness of the interview for health by the occupational health nurses (Table 2-c) were greater with statistical significance (p < 0.05) (Table 3) than those of the subjects who evaluated the interview highly (Table 2-b).

It is difficult for employees of a corporation to set low values on the interview in health checkups conducted in their corporation using questionnaire with their identification numbers. More than 80% (632/750 = 0.843 and 671/746 = 0.899) of the subjects set a high value on the health interview by the occupational health nurses regarding usefulness and understanding, indicating that the health checkup was favorably regarded in the corporation. It was reported that about 60% of the subjects were satisfied with the health checkup of their company,¹⁴ and more than 75% with the interview for health.¹⁷ Subjects who set a low value on the interview conducted in their corporation are not part of the majority group, indicating a special character. It can be considered that the subjects

Table 2 Variations in health checkup results for one year from 1999 to 2000 in subjects who highly evaluated usefulness of the interview for health in the health checkup and those who did not and odds ratios in conditional logistic analysis for the variations with their 95% confidence intervals

| All subjects | | | | | | | | |
|--------------|--------------------|-----------|-----------|-----------|-------------------------------|------|------|---------|
| Year | Number of subjects | | | | | | | |
| 1999 | Healthy | Healthy | Unhealthy | Unhealthy | Conditional logistic analysis | | | alysis |
| 2000 | Healthy | Unhealthy | Healthy | Unhealthy | Odds ratio | 95% | 6 CI | p-value |
| BMI | 586 | 24 | 18 | 122 | 1.33 | 2.46 | 0.72 | |
| SBP | 690 | 25 | 13 | 22 | 1.92 | 3.76 | 0.98 | |
| DBP | 691 | 25 | 14 | 20 | 1.79 | 3.44 | 0.93 | |
| BS | 606 | 47 | 83 | 13 | 0.57 | 0.81 | 0.40 | < 0.01 |
| T-Cho | 575 | 34 | 31 | 109 | 1.10 | 1.78 | 0.67 | |
| TG | 407 | 93 | 95 | 154 | 0.98 | 1.30 | 0.74 | |
| HDL-C | 653 | 22 | 30 | 44 | 0.73 | 1.27 | 0.42 | |
| AST | 691 | 17 | 18 | 23 | 0.94 | 1.83 | 0.49 | |
| ALT | 590 | 42 | 43 | 74 | 0.98 | 1.49 | 0.64 | |
| γ-GTP | 650 | 21 | 17 | 61 | 1.24 | 2.34 | 0.65 | |

(Table 2-a)

CI: confidence interval, BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, BS: blood sugar, T-Cho: total cholesterol, TG: triglyceride, HDL-C: high-density lipoprotein cholesterol, AST: aspartate aminotransferase, ALT: alanine aminotransferase, γ-GTP: γ-glutamyltranspeptitase

(Table 2-b)

| Subjects who highly evaluated usefulness of the interview for health | | | | | | | | |
|--|-------------------------------------|-----------|---------|-------------------------------|------------|------|------|---------|
| Year | Number of subjects | | | | | | | |
| 1999 | Healthy Healthy Unhealthy Unhealthy | | | Conditional logistic analysis | | | | |
| 2000 | Healthy | Unhealthy | Healthy | Unhealthy | Odds ratio | 95% | 6 CI | p-value |
| BMI | 491 | 18 | 18 | 105 | 1.00 | 1.92 | 0.52 | |
| SBP | 582 | 18 | 11 | 21 | 1.64 | 3.46 | 0.77 | |
| DBP | 581 | 20 | 13 | 18 | 1.54 | 3.09 | 0.77 | |
| BS | 511 | 39 | 69 | 12 | 0.57 | 0.84 | 0.38 | < 0.01 |
| T-Cho | 483 | 28 | 26 | 94 | 1.08 | 1.84 | 0.63 | |
| TG | 337 | 73 | 86 | 135 | 0.85 | 1.16 | 0.62 | |
| HDL-C | 553 | 16 | 23 | 39 | 0.70 | 1.32 | 0.37 | |
| AST | 581 | 15 | 16 | 19 | 0.94 | 1.90 | 0.46 | |
| ALT | 496 | 38 | 35 | 62 | 1.09 | 1.72 | 0.69 | |
| γ-GTP | 545 | 19 | 16 | 51 | 1.19 | 2.31 | 0.61 | |

(Table 2-c)

| Subjects who lowly evaluated usefulness of the interview for health | | | | | | | | |
|---|--------------------|-----------|-----------|--|------------|-------|------|---------|
| Year | Number of subjects | | | | | | | |
| 1999 | Healthy | Healthy | Unhealthy | ealthy Unhealthy Conditional logistic analysis | | | | alysis |
| 2000 | Healthy | Unhealthy | Healthy | Unhealthy | Odds ratio | 95% | 6 CI | p-value |
| BMI | 95 | 6 | 0 | 17 | | | | < 0.05 |
| SBP | 108 | 7 | 2 | 1 | 3.50 | 16.85 | 0.73 | |
| DBP | 110 | 5 | 1 | 2 | 5.00 | 42.80 | 0.58 | |
| BS | 95 | 8 | 14 | 1 | 0.57 | 1.36 | 0.24 | |
| T-Cho | 92 | 6 | 5 | 15 | 1.20 | 3.93 | 0.37 | |
| TG | 70 | 20 | 9 | 19 | 2.22 | 4.88 | 1.01 | < 0.05 |
| HDL-C | 100 | 6 | 7 | 5 | 0.86 | 2.55 | 0.29 | |
| AST | 110 | 2 | 2 | 4 | 1.00 | 7.10 | 0.14 | |
| ALT | 94 | 4 | 8 | 12 | 0.50 | 1.66 | 0.15 | |
| γ-GTP | 105 | 2 | 1 | 10 | 2.00 | 22.06 | 0.18 | |

who lowly evaluated the usefulness of the interview might have been reluctant to be interviewed. It can be supposed that some of them may not be interested in their health and not have any intention of improving their lifestyle. This is not inconsistent with the deterioration of BMI and TG values they showed for one year in the present study. It is possible that the deterioration of BMI and TG indicates that some subjects who lowly evaluated the usefulness of the interview may eat high energy foods including rich fat resulting in increased body weight. The deterioration of BMI and TG can be considered to be derived from the same background. It is not likely that the deterioration was detected by chance. BMI and TG values objectively observed are reliable, while information on lifestyle usually obtained by subjective questionnaire is not always reliable. In the present study, the deterioration in lifestyle obtained by the self-administered questionnaire among the subjects who lowly evaluated the interview for health could not be detected. Table 3 shows that the number of greater odds ratios than 1.0 is much greater than that of less than 1.0. Low recipient evaluation of the usefulness of the interview in the health checkup may be regarded as a risk factor of metabolic syndrome. This finding is useful practically for occupational health systems in corporations, because health care staff can pay attention to the deterioration of health status in the subjects who lowly evaluate health checkup from the viewpoint of preventing lifestyle-related diseases.

However, this finding is not proved biologically in the present study because of the limitations on an observational study. Therefore, strict studies should be conducted in order to prove deterioration of medical examination values in subjects who lowly evaluate interviews in health checkups from the viewpoint of biological mechanism.

The authors analyzed the data in 1999 on the same male subjects as the present study and reported¹⁸ that those subjects who complained of many problems regarding physical symptoms, mental symptoms, occupational environment, and daily lifestyle in the questionnaire were apt to set a high value on the interview and the intervention as a cross-sectional study. Relationships between complaints in the questionnaire and recipient evaluation of understanding the interview by the public health nurses were especially notable. Common findings regarding the way of the health checkup is conducted among the occupational health nurses in the corporation as follows. The occupational health nurses usually take 7-10 minutes for the interview and the intervention in the health checkup. They take more time, at most 20 minutes, for the subjects who complain of many problems or whose examination values are abnormal. Spending more time to the interview and intervention in the health checkup may be a cause of high evaluation by the subjects who complain of many problems. The present study indicated the deterioration of BMI and TG over one year among the subjects who set a low value on the usefulness of the interview for health as a longitudinal study. The above two studies using the same group show different aspects of study results between cross-sectional and longitudinal studies. A significant relationship between high recipient evaluation of understanding the interview and complaints in the cross-sectional study¹⁸ and between low recipients' evaluation of the usefulness of the interview and deterioration of results in checkup examinations in the present longitudinal study was detected. Significance of evaluation for the usefulness of the interview must be different from that for understanding.

The relationship between recipient evaluation of the interview conducted by the occupational health nurses for usefulness and understanding (O.1 and 2 in Appendix) was analyzed statistically, showing a strong positive relationship. The statistical analyses for the relationship between recipient evaluation of understanding the interview (Q.2 in Appendix) and variations in health checkup results for one year from 1999 to 2000 revealed no notable findings. This means that the recipients' evaluation of the interview for usefulness is similar to that for understanding, but the two are different from each other. The recipients' evaluation for usefulness may be that for the contents of the interview and the evaluation for understanding may be that for the ability of giving information on health in the interview by the occupational health nurses. This difference between the two evaluation items of the interview may be expressed by the difference between findings for (i) the remarkable relationship between recipients' evaluation of understanding the interview and complaints in the previous cross-sectional study¹⁸ and (ii) the relationship between the recipients' evaluation of the usefulness of the interview and variations of the data in health checkup examinations in the present longitudinal study.

Table 2 shows statistically significant (p<0.01) improvement of BS for all subjects and the subjects who highly evaluated the interview (Tables 2-ab), but not for the subjects who lowly evaluated the interview (Table 2-c). The three odds ratios in conditional logistic analysis according to the groups, however, were nearly equal to each other, showing that the ratio between (i) the odds ratio between deterioration and improvement of BS in the subjects who lowly evaluated the usefulness of the interview and (ii) that in the subjects who did not was 1.01 (N.S.) (i.e., no interaction in Table 3). In the present study, the difference between the subjects who lowly evaluated the interview and the subjects who did not is the most important indicator. This indicates that similar biases must affect the BS values in the two groups with and without high recipient evaluation. The reason for the improvement of BS can be elucidated. The methods, season, time, staff, and the institution conducting the blood tests of the health checkup in 1999 were the same as those in 2000. As biases of BS, differences between measurement lots in 1999 and 2000 and amounts of food intake before drawing blood can be enumerated. Fasting is desirable before drawing blood for determination of BS in health checkups. However, fasting is not always observed by the recipients of the health checkup. Fasting may have been conducted more firmly by the recipients in 2000 than in 1999. The bias of BS is not important in the present study because it is independent of the difference between groups with high and low recipient evaluation of the usefulness of the interview for health. Notable findings for BS from statistical analyses were not detected in any other except those in Tables 2-ab.

Notable findings were not detected from the statistical analyses for the relationship between the intervention in lifestyle (Q.a-d, 3-10 in Appendix) and variations in health checkup results including improvement of lifestyle for one year from 1999 to 2000. This indicates that the deterioration of the health checkup results in the subjects who evaluated the usefulness of the interview lowly is independent of the intervention for a healthy lifestyle. The number of subjects who received intervention to encourage them to lead a more healthy lifestyle was not large,¹⁸ and the occupational health nurses in the corporation are not required to conduct effective intervention. The previous cross-sectional study¹⁸ did not find significant differences in results among the public health nurses who conducted the interview and the intervention in the health checkup in 1999.

The variation in recipients' lifestyle (e.g. smoking, drinking, exercise, and eating) obtained from the self-administered questionnaire for one year from 1999 to 2000 was not influenced by their evaluation of the interview and the intervention by the occupational health nurses and recipients' consciousness of receiving intervention for healthy lifestyle (Appendix). Occupational health nurses are not required to conduct an intervention that must result in measurable improvement of a recipient's lifestyle in the corporation. It is difficult to determine whether intervention by consultation for a healthy lifestyle in the corporation is effective. This means that changing lifestyle is difficult, indicating coincidence with previous reports.^{20–22} In the present study, it could not be determined whether deterioration of BMI and TG in the subjects who lowly evaluated the usefulness of the interview derived from deterioration of their lifestyle and/or lack of intervention to encourage a healthy lifestyle by the occupational health nurses. Information on evaluation, intervention, and lifestyle was obtained by self-administered questionnaires, thus it is not objective. It is not appropriate that we discuss thoroughly the relationship among the intervention for healthy lifestyle, the improvement of lifestyle, the improvement of the exami-

Table 3 Odds ratios with their 95% confidence intervals and statistical tests for relationship between (i) variations in health checkup results for one year from 1999 to 2000 and (ii) evaluation regarding usefulness of the interview for health

| | Odds ratio | 95% CI | | p-value |
|-------|------------|--------|------|---------|
| BMI | 00 | | | < 0.05 |
| SBP | 2.14 | 12.20 | 0.37 | |
| DBP | 3.25 | 31.08 | 0.34 | |
| BS | 1.01 | 2.62 | 0.39 | |
| T-Cho | 1.11 | 4.09 | 0.30 | |
| TG | 2.62 | 6.10 | 1.12 | < 0.05 |
| HDL-C | 1.23 | 4.36 | 0.35 | |
| AST | 1.07 | 8.56 | 0.13 | |
| ALT | 0.46 | 1.66 | 0.13 | |
| γ-GTP | 1.68 | 20.33 | 0.14 | |

CI: confidence interval, BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, BS: blood sugar, T-Cho: total cholesterol, TG: triglyceride, HDL-C: high-density lipoprotein cholesterol, AST: aspartate aminotransferase, ALT: alanine aminotransferase, γ -GTP: γ -glutamyltranspeptitase

nation results in health checkup, and the recipient evaluation of the intervention in the present study.

Further analyses on the differences in variations of complaint symptoms in a self-administered questionnaire after health checkup between the subjects who lowly evaluated the interview for health and those who did not should be conducted as a longitudinal study.

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References

- 1. Health and Welfare Statistical Association: Death. Kosei no Shihyo (J Health Welfare Stat) 2006; 53(9s): 43–55 (in Japanese)
- Dawber TR: The Framingham study: the epidemiology of atherosclerotic disease. Cambridge, Harvard University Press 1980; 1– 275
- Berkman LF, Breslow L: Health and Ways of Living: the Alameda County Study. New York, Oxford University Press 1983; 1–237
- Kaplan GA, Seeman TE, Cohen RD, Knudsen LP, Guralnik J: Mortality among the elderly in The Alameda County Study: behavioral and demographic risk factor. Am J Public Health 1987; 77: 307–312
- Ostwald SK: Changing employees' dietary and exercise practices: an experimental study in a small company. J Occup Med 1989; 31: 90–97
- 6. Ornish D, Brown SE, Scherwitz LW, Billings JH, Armstrong WT,

Ports TA, McLanahan SM, Kirkeeide RL, Brand RJ, Gould KL: Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. Lancet 1990; 336: 129–133

- National High Blood Pressure Education Program Coordinating Committee: The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Arch Intern Med 1997; 157: 2413–2446
- Scheuermann W, Razum O, Scheidt R, Wiesemann A, von Frankenberg H, Topf G, Nussel E: Effectiveness of a decentralized, community-related approach to reduce cardiovascular disease risk factor levels in Germany. Eur Heart J 2000; 21: 1591–1597
- Tuomilehto J, Lindstrom J, Eriksson JG: The Finnish Diabetes Prevention Study Group. Prevention of type 2 diabetes mellitus by change in lifestyle among subjects with impaired glucose tolerance. New Eng J Med 2001; 344: 1343–1350
- Health Service Bureau, Ministry of Health, Labour and Welfare, Government of Japan: Standard Health Checkup and Health Consultation Program (provisional version). 2006 (in Japanese) http:// www.mhlw.go.jp/bunya/kenkou/seikatsu/pdf/02.pdf
- Ministry of Labour, Government of Japan: Rodo Hakusho 1995 (White Paper on Labour 1995). Tokyo, Japan Labour Study Organization, 1995; 71–72 (in Japanese)
- 12. Kuriyama S, Shimazu T, Hozawa A, Yabe M, Tasaki M, Mononaga Y, Sakai M, Miura C, Ito F, Ito T, Yabe H, Nitta S, Suzuki R, Fujita K, Nagatomi R, Tsuji I: Comparison of intensive and moderate individual life-style intervention programs for overweight or obese persons with fasting glucose levels of 95–125 ng/dl in Japan. Nihon Koshu Eisei Zasshi (Jpn J Public Health) 2006; 53: 122–132 (in Japanese with English abstract)
- Meland E, Laerum E, Maeland JG: Life style intervention in general practice: effects on psychological well-being and patient satisfaction. Qual Life Res 1996; 5: 348–354
- Ezaki T, Honda S, Hashimoto H, Jahng D: Employees' satisfaction and the influential process factor during regular health checkup by a contracted industrial health association. San Ei Shi 1999;

41: 159-165 (in Japanese with English abstract)

- Kudo Y, Satoh T, Hosoi K, Aizawa Y: Factors associated with satisfaction among participants in a periodical worksite health checkup in Japan. J Occup Health 2004; 46: 461–469
- Kudo Y, Satoh T, Hosoi K, Aizawa Y: Participants' satisfaction in a periodic worksite health check-up. Sogo Kenshin (Health Eval Promot) 2005; 32: 287–293 (in Japanese with English abstract)
- 17. Azuma T, Takubo N, Komine S: How to have be satisfied healthadvice? San Ei Shi 2000; 42(S): 257 (in Japanese)
- Shimada N, Otahara Y, Shimizu H, Minowa H, Hattori Y, Sugita M: Relationship between recipients' evaluation of interview for health and intervention for improving lifestyle by occupational health nurses and complaints in self-administered questionnaire in a company health checkup. Kenko Kaihatsu (Health Develop) 2007; 12: 42–55 (in Japanese with English abstract)
- Sugita M, Izuno T, Kanamori M, Ogoshi K, Mitomi T: An indicator quantitatively comparing two treatment effect sizes on responder and non-responder groups: exponential of estimated interaction parameters. Cancer Immunol Immunother 1995; 41: 251–256
- Ando K: Improvement of lifestyles, effects and limits, restricting salt intake. Ketsuatsu (Blood Pressure) 2004; 11: 133–139 (in Japanese)
- Tsukiyama H, Shigemasa T, Otsuka K: Improvement of lifestyles, effects and limits, stress management. Ketsuatsu (Blood Pressure) 2004; 11: 173–178 (in Japanese)
- 22. Soga K, Matsumoto N, Saho Y, Adachi A, Nakaura T, Akashi M: A study of the way to ameliorate living habits: for people with hyperlipidemia. Nichinoishi (JJRM) 2003; 52: 53–64 (in Japanese with English abstract)
- 23. Sugita M, Otahara Y, Fujishige T, Sato K, Tada A, Yamamoto M, Takeoka Y, Suzuki M, Minowa H, Hattori Y: Difference between consciousness of intervention for improving lifestyle by public health nurses and recipients of a company health check. J Epidemiol 2002; 12: 287–294

Appendix Questionnaire for evaluation of interview and intervention by occupational health nurses

Q.1 Do you think that the interview by an occupational health nurse in health check-up is useful? 1. Very useful 2. Somewhat useful 3. Slightly useful 4. Not useful Q.2 Did you understand the interview by an occupational health nurse in health check-up? 1. Very much 2. Somewhat 3. Slightly 4. Not Q.a Did you accept the intervention of abstinence from smoking by an occupational health nurse? 1. No 2. Yes Ţ Ţ Q.3 Do you think that the intervention for abstinence from smoking is useful? 1. Very useful 2. Somewhat useful 3. Slightly useful 4. Not useful 0.4 Do you understand to the intervention regarding abstinence from smoking? 1. Very much 2. Somewhat 3. Slightly 4. Not O.b Did you accept the intervention to stop or reduce drinking by an occupational health nurse? 1. No 2. Yes Ţ Ţ Q.5 Do you think that the intervention regarding drinking is useful? 1. Very useful 2. Somewhat useful 3. Slightly useful 4. Not useful Q.6 Do you understand to the intervention regarding drinking? 1. Very much 2. Somewhat 3. Slightly 4. Not Q.c Did you accept the intervention to do exercise by an occupational health nurse? 1. No 2. Yes 0.7 Do you think that the intervention for exercise is useful? 1. Very useful 2. Somewhat useful 3. Slightly useful 4. Not useful Q.8 Do you understand to the intervention for exercise? 1. Very much 2. Somewhat 3. Slightly 4. Not Q.d Did you accept the intervention regarding eating by an occupational hearth nurse? 1. No 2. Yes Ţ Q.9 Do you think that the intervention regarding eating is useful? 1. Very useful 2. Somewhat useful 3. Slightly useful 4. Not useful Q.10 Do you understand to the intervention regarding eating? 1. Very much 2. Somewhat 3. Slightly 4. Not