

# Characteristics of Lifestyle and Health Status of Workers in Small-Scale Enterprises in Japan

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**Abstract:** This study was conducted to clarify the characteristics of small-scale enterprises (SSEs) with fewer than 50 workers, which employ 62.2% of all Japanese workers. Subjects were 71,183 workers employed at 1,761 workplaces in Tochigi, Japan, in 2002. Frequencies of abnormal lifestyle and health check-up data were described according to the category of the enterprise. Adjusted odds ratios (ORs) of the abnormal findings were calculated by logistic regression analysis. Dose-response relationships were calculated by trend tests. The frequency of abnormal findings was higher in SSEs than in other categories of enterprises. The ORs of work intensity, alcohol consumption, current smoker, and the Brinkmann index were higher in SSEs than in large-scale enterprises (LSEs) and were also significant in trend tests. The ORs of audiometry, hypertension, glucose in urine and ECG in males and females, BMI, liver function, lipid metabolism, and blood sugar in females, chest X-ray, and anemia in males were higher in SSEs. Audiometry, hypertension, anemia, ECG in both males and females; chest X-ray, and glucose in urine in males, and liver function, lipid metabolism and blood sugar in females showed significant results in trend tests. Overall health and healthy lifestyle in SSEs were worse than in LSEs.

**Key words:** Health check-up, Health status, Lifestyle, Occupational health, Small-scale Enterprises, Size of enterprise

## Introduction

In Japan, all workers in enterprises are legally required to have a periodic health check-up. Any employer employing more than 50 workers must report the results of these health check-ups to the Labor Standards Inspection Office. In other words, because employers employing less than 50 workers are not required to report health check-up results, a lower frequency of health check-ups and a higher frequency of abnormal findings in small-scale enterprises (SSEs) have been reported<sup>1,2</sup>. However, the particular results for SSEs are far less frequently published in government literature than others categories of enterprises.

Since those employed in SSEs account for 62.2% of all

Japanese workers, they represent an important labor force in socioeconomic activities, and SSEs are operated in all areas in Japan. Therefore it is important to ensure that both the basic health and a healthy lifestyle are maintained among workers in SSEs<sup>3</sup>. Although these two factors are considered worse when compared with those in large-scale enterprises (LSEs), very few studies have investigated this discrepancy. This present study was conducted in order to clarify the characteristics of SSE workers in Japan.

## Materials and Methods

The subjects of this study were 71,183 workers (male: 46,454; female: 24,729) from 1,761 workplaces in Tochigi, Japan, in 2002. Health check-up data were provided by T Association, which organized the health check-ups.

Each workplace was classified into one of the five

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categories according to the number of employees: small-scale enterprises (SSEs): number of workers < 50; 50-worker enterprises (50Es): 50 ≤ number of workers < 100; 100-worker enterprises (100Es): 100 ≤ number of workers < 300; 300-workers enterprises (300Es): 300 ≤ number of workers < 1,000; and large-scale enterprises (LSEs): number of workers ≥ 1,000.

Lifestyle was assessed using a questionnaire on work intensity, smoking habits and alcohol consumption, and the responses were given in parentheses: Work intensity (weak, slightly weak, moderate, strong), smoking habits (yes, no, number of cigarettes per day and number of years smoking), and alcohol consumption (none, drink several days per week, drink everyday of the week). The Brinkmann index was calculated as the number of cigarettes per day multiplied by multiplying the number of cigarettes per day by the number of years smoking.

Health status was assessed by measuring height, weight, blood pressure (systolic blood pressure, diastolic blood pressure), blood and urine test data, and audiometric data.

Body Mass Index (BMI) was calculated as body weight (kg) divided by the square of height (m<sup>2</sup>).

Blood tests included measurements of red blood cell count (RBC), hemoglobin (Hb), glutamic-oxaloacetic transaminase (GOT), glutamic-pyruvic transaminase (GPT), gamma-glutamyl transpeptidase (rGTP), total cholesterol (TC), triglyceride (TG), HDL-cholesterol (HDL), and blood sugar (BS).

The presence of glucose and protein in urine was determined by urine tests. The presence of protein in urine was not determined during and three days after the menstrual period.

The health check-up items in the present study were the same as those reported to the Labor Standards Inspection Office.

The criteria for abnormal findings in health check-up items are shown in Table 1. If a subject was undergoing medical treatment for any health check-up item, that item was considered to be an abnormal finding.

In this epidemiological survey, subjects' identities are both anonymous and unlinked to the data presented herein, as described in "ETHICAL GUIDELINES FOR EPIDEMIOLOGICAL RESEARCH"<sup>24</sup>.

Frequencies of abnormal findings in lifestyle and health check-up data were described according to the category of the enterprise and the differences in frequencies of the variables between SSEs and LSEs were assessed using a chi-square test. The odds ratio (OR) of SSE workers' lifestyle and health status was calculated by logistic regression analysis using corresponding data from LSEs as a reference. The dose-response relationship was calculated by trend tests, after adjusting for age and sex, respectively. The SPSS 13.0 statistical software package for Windows (SPSS Japan Inc, Tokyo, Japan) was used for all statistical analysis.

**Table 1. Criteria of the abnormal findings**

| Health check-ups items  | Criteria   |
|-------------------------|--|
| Work intensity          | Labor strength is strong: more than 1.9 times for the basal metabolic rate   |
| Alcohol consumption     | Drinking every day of the week   |
| Current smoker          | Current smoking  |
| Brinkmann index         | Brinkmann index > 399  |
| Body mass index (BMI)   | BMI > 24.9   |
| Audiometry (1,000 Hz)   | Hearing of 1,000 Hz > 30 dB  |
| Audiometry (4,000 Hz)   | Hearing of 4,000 Hz > 40 dB  |
| Chest X-ray             | Diagnosed by a doctor  |
| Hypertension            | SBP > 139 mmHg, and/or DBP > 89 mmHg   |
| Anemia                  | Male: Hb < 13.5 g/dl, and/or RBC < 420 × 10 <sup>4</sup> /μl<br>Female: Hb < 11.5 g/dl, and/or RBC < 370 × 10 <sup>4</sup> /μl |
| Liver function          | GOT > 44 IU/l, and/or GPT > 49 IU/l, and/or rGTP > 59 IU/l   |
| Lipid metabolism        | TC > 219 mg/dl, and/or TG > 149, and/or HDL < 40 mg/dl<br>( female aged more than 50: TC > 239 mg/dl )                         |
| Blood sugar             | Blood sugar > 109 mg/dl (BS after eating > 139 mg/dl)  |
| Glucose in urine        | Glucose in urine (±) ~ (3+)  |
| Protein in urine        | Protein in urine (±) ~ (3+)  |
| Electrocardiogram (ECG) | Diagnosed by two doctors   |

Protein in urine was not decided among menstrual period and after three days.

SBP: systolic blood pressures, DBP: diastolic blood pressure

**Table 2. Distribution of number of enterprises and workers in different categories of enterprises**

|                           | SSEs<br><50<br>n (%) | 50Es<br>50~99<br>n (%) | 100Es<br>100~299<br>n (%) | 300Es<br>300~999<br>n (%) | LSEs<br>>999<br>n (%) | Total<br>n (%) |
|---------------------------|----------------------|------------------------|---------------------------|---------------------------|-----------------------|----------------|
| The number of enterprises | 1,535 (87.2)         | 108 (6.1)              | 88 (5.0)                  | 23 (1.3)                  | 7 (0.4)               | 1,761 (100)    |
| The number of workers     |                      |                        |                           |                           |                       |                |
| Male                      | 8842 (19.0)          | 4607 (9.9)             | 8613 (18.5)               | 8201 (17.7)               | 16191 (34.9)          | 46454 (100)    |
| Female                    | 5194 (21.0)          | 2962 (12.0)            | 4438 (17.9)               | 3606 (14.6)               | 8529 (34.5)           | 24729 (100)    |
| Total                     | 14036 (19.8)         | 7569 (10.6)            | 13051 (18.3)              | 11807 (16.6)              | 24720 (34.7)          | 71183 (100)    |

**Table 3. Frequency of the abnormal findings in different categories of enterprises by sex**

|                         | Frequency of the abnormal findings (%) |               |                  |                  |              |          |             |               |                  |                  |              |          |
|-------------------------|--|---------------|------------------|------------------|--------------|----------|-------------|---------------|------------------|------------------|--------------|----------|
|                         | Male                                   |               |                  |                  |              |          | Female      |               |                  |                  |              |          |
|                         | SSEs<br><50                            | 50Es<br>50~99 | 100Es<br>100~299 | 300Es<br>300~999 | LSEs<br>>999 | p-values | SSEs<br><50 | 50Es<br>50~99 | 100Es<br>100~299 | 300Es<br>300~999 | LSEs<br>>999 | p-values |
| Work intensity          | 7.6                                    | 5.6           | 6.0              | 6.8              | 4.3          | <0.01    | 4.8         | 6.1           | 3.5              | 4.9              | 1.3          | <0.01    |
| Alcohol consumption     | 37.7                                   | 32.1          | 33.4             | 36.4             | 28.5         | <0.01    | 6.4         | 6.4           | 4.6              | 5.1              | 4.5          | <0.01    |
| Current smoker          | 60.3                                   | 58.3          | 54.0             | 53.1             | 42.8         | <0.01    | 16.3        | 19.4          | 12.2             | 9.3              | 5.8          | <0.01    |
| Brinkmann index (> 399) | 47.9                                   | 38.4          | 44.1             | 45.1             | 39.4         | <0.01    | 13.3        | 8.9           | 8.9              | 9.6              | 5.7          | <0.01    |
| BMI                     | 30.3                                   | 28.8          | 30.5             | 25.3             | 30.2         | >0.05    | 18.7        | 15.8          | 15.2             | 15.8             | 11.8         | <0.01    |
| Audiometry (1,000 Hz)   | 5.1                                    | 3.4           | 3.1              | 3.3              | 2.8          | <0.01    | 4.0         | 3.3           | 3.1              | 3.7              | 1.6          | <0.01    |
| Audiometry (4,000 Hz)   | 15.1                                   | 8.7           | 9.4              | 11.4             | 6.3          | <0.01    | 3.2         | 2.1           | 1.8              | 2.6              | 1.1          | <0.01    |
| Chest X-ray             | 5.8                                    | 5.0           | 4.3              | 4.8              | 3.6          | <0.01    | 3.1         | 3.0           | 2.7              | 3.1              | 2.1          | >0.05    |
| Hypertension            | 23.7                                   | 19.2          | 21.2             | 20.2             | 16.9         | <0.01    | 12.5        | 10.2          | 10.3             | 13.1             | 5.5          | <0.01    |
| Anemia                  | 5.7                                    | 4.6           | 5.2              | 3.3              | 3.9          | <0.01    | 11.6        | 13.2          | 13.1             | 11.6             | 13.4         | >0.05    |
| Liver function          | 19.8                                   | 17.4          | 18.7             | 15.9             | 19.0         | >0.05    | 4.3         | 3.2           | 3.4              | 2.8              | 2.1          | <0.01    |
| Lipid metabolism        | 46.8                                   | 46.0          | 47.0             | 44.6             | 44.0         | <0.01    | 27.0        | 25.3          | 23.9             | 23.5             | 16.8         | <0.01    |
| Blood sugar             | 13.2                                   | 13.1          | 12.7             | 9.7              | 10.2         | <0.01    | 5.6         | 5.9           | 3.8              | 4.9              | 2.2          | <0.01    |
| Glucose in urine        | 4.7                                    | 5.0           | 4.2              | 3.5              | 3.1          | <0.01    | 1.1         | 0.8           | 1.0              | 1.6              | 0.6          | <0.01    |
| Protein in urine        | 3.5                                    | 3.4           | 3.2              | 3.6              | 2.7          | <0.01    | 2.1         | 2.1           | 1.9              | 2.8              | 1.8          | >0.05    |
| ECG                     | 21.5                                   | 19.5          | 20.8             | 20.8             | 17.6         | <0.01    | 15.8        | 13.3          | 13.3             | 17.7             | 10.0         | <0.01    |

P-values: Frequency of difference between SSEs and LSEs by chi-square test.

## Results

The numbers of enterprises and subjects in the SSEs, 50Es, 100Es, 300Es, and LSEs are shown in Table 2. The most common enterprise was found to be SSEs (87.2%). However, the number of workers in SSEs (19.8%) was smaller than that in LSEs (34.7%).

Frequencies of abnormal findings according to the categories of enterprises are shown by sex in Table 3. Abnormal findings occurred more frequently in SSEs when compared to LSEs. Excluding BMI and liver function in males, chest X-ray, anemia and protein in urine in females, the frequencies of all the other items were significantly higher in SSEs than those in LSEs, as according to by chi-square test.

The ORs for work intensity, alcohol consumption, current

smoker and the Brinkmann index among males employed at SSEs were found to be significant.

Trend test results for males were significant (Table 4). The OR and trend test results for females were also significant (Table 5).

The ORs of males for audiometry (1,000 Hz and 4,000 Hz), chest X-ray, hypertension, anemia, glucose in urine, and ECG were significant (Table 4). The ORs for females for BMI, audiometry (1,000 Hz and 4,000 Hz), hypertension, anemia, liver function, lipid metabolism, blood sugar, glucose in urine, and ECG were significant (Table 5).

Audiometry (1,000 Hz and 4,000 Hz), hypertension, anemia and ECG in both males and females; chest X-ray and glucose in urine in males, and BMI, liver function, lipid metabolism and blood sugar in females showed significant results in trend tests (Tables 4 and 5).

**Table 4. Adjusted odds ratios (OR) and 95% confidence interval of the abnormal findings by categories of enterprises in male**

|                         | OR               |                  |                  |                  |      | P for Trend |
|-------------------------|------------------|------------------|------------------|------------------|------|-------------|
|                         | SSEs             | 50Es             | 100Es            | 300Es            | LSEs |             |
|                         | <50              | 50-99            | 100-299          | 300-999          | >999 |             |
| Work intensity          | 1.80 (1.60-2.04) | 1.33 (1.14-1.56) | 1.42 (1.24-1.61) | 1.61 (1.42-1.84) | 1.00 | <0.01       |
| Alcohol consumption     | 1.33 (1.25-1.41) | 1.15 (1.07-1.24) | 1.14 (1.07-1.21) | 1.33 (1.25-1.41) | 1.00 | <0.01       |
| Current smoker          | 2.06 (1.95-2.18) | 1.88 (1.75-2.01) | 1.59 (1.50-1.68) | 1.53 (1.45-1.62) | 1.00 | <0.01       |
| Brinkmann index (> 399) | 1.71 (1.54-1.91) | 1.45 (1.26-1.66) | 1.26 (1.13-1.41) | 1.33 (1.19-1.49) | 1.00 | <0.01       |
| BMI                     | 0.96 (0.90-1.02) | 0.92 (0.86-0.99) | 0.99 (0.93-1.05) | 0.76 (0.71-0.81) | 1.00 | >0.05       |
| Audiometry (1,000 Hz)   | 1.37 (1.18-1.58) | 1.07 (0.87-1.31) | 0.96 (0.80-1.14) | 1.06 (0.89-1.25) | 1.00 | <0.01       |
| Audiometry (4,000 Hz)   | 1.88 (1.70-2.08) | 1.22 (1.06-1.40) | 1.31 (1.17-1.47) | 1.76 (1.58-1.96) | 1.00 | <0.01       |
| Chest X-ray             | 1.36 (1.17-1.58) | 1.34 (1.10-1.62) | 1.14 (0.96-1.34) | 1.31 (1.11-1.54) | 1.00 | <0.01       |
| Hypertension            | 1.20 (1.12-1.29) | 1.06 (0.97-1.17) | 1.14 (1.06-1.22) | 1.13 (1.05-1.22) | 1.00 | <0.01       |
| Anemia                  | 1.18 (1.03-1.36) | 1.03 (0.85-1.25) | 1.16 (1.00-1.34) | 0.83 (0.71-0.98) | 1.00 | <0.01       |
| Liver function          | 1.03 (0.96-1.11) | 0.89 (0.80-0.98) | 0.96 (0.89-1.04) | 0.80 (0.74-0.87) | 1.00 | >0.05       |
| Lipid metabolism        | 1.02 (0.96-1.09) | 1.03 (0.95-1.12) | 1.04 (0.98-1.11) | 1.01 (0.95-1.08) | 1.00 | >0.05       |
| Blood sugar             | 1.00 (0.91-1.11) | 1.09 (0.96-1.24) | 1.03 (0.93-1.14) | 0.92 (0.83-1.02) | 1.00 | >0.05       |
| Glucose in urine        | 1.19 (1.03-1.37) | 1.48 (1.25-1.75) | 1.18 (1.02-1.36) | 1.05 (0.90-1.23) | 1.00 | <0.01       |
| Protein in urine        | 1.14 (0.97-1.33) | 1.19 (0.98-1.44) | 1.09 (0.93-1.28) | 1.28 (1.09-1.50) | 1.00 | >0.05       |
| ECG                     | 1.11 (1.03-1.20) | 1.02 (0.92-1.13) | 1.09 (1.00-1.18) | 1.08 (0.99-1.17) | 1.00 | <0.05       |

OR: The odds ratio of workers in SSEs was calculated based on corresponding data from LSEs, adjusting for age.

P for trend: Results of trends test.

**Table 5. Adjusted odds ratios (OR) and 95% confidence interval of the abnormal findings by categories of enterprises in female**

|                         | OR               |                  |                  |                  |      | P for Trend |
|-------------------------|------------------|------------------|------------------|------------------|------|-------------|
|                         | SSEs             | 50Es             | 100Es            | 300Es            | LSEs |             |
|                         | <50              | 50-99            | 100-299          | 300-999          | >999 |             |
| Work intensity          | 3.19 (2.48-4.10) | 4.46 (3.43-5.80) | 2.49 (1.90-3.25) | 3.11 (2.37-4.09) | 1.00 | <0.01       |
| Alcohol consumption     | 1.31 (1.12-1.54) | 1.37 (1.14-1.66) | 0.96 (0.80-1.15) | 1.02 (0.83-1.24) | 1.00 | <0.01       |
| Current smoker          | 3.48 (3.07-3.94) | 4.15 (3.63-4.76) | 2.41 (2.10-2.75) | 1.86 (1.59-2.17) | 1.00 | <0.01       |
| Brinkmann index (> 399) | 1.60 (0.95-2.67) | 1.28 (0.72-2.26) | 1.13 (0.64-2.00) | 0.69 (0.36-1.32) | 1.00 | <0.01       |
| BMI                     | 1.39 (1.25-1.54) | 1.21 (1.07-1.38) | 1.19 (1.06-1.33) | 1.07 (0.94-1.22) | 1.00 | <0.01       |
| Audiometry (1,000 Hz)   | 1.59 (1.24-2.04) | 1.53 (1.14-2.05) | 1.59 (1.21-2.11) | 1.45 (1.08-1.93) | 1.00 | <0.01       |
| Audiometry (4,000 Hz)   | 1.65 (1.23-2.21) | 1.33 (0.93-1.91) | 1.25 (0.88-1.78) | 1.36 (0.96-1.93) | 1.00 | <0.01       |
| Chest X-ray             | 1.16 (0.84-1.61) | 1.22 (0.85-1.76) | 1.17 (0.82-1.66) | 1.13 (0.78-1.66) | 1.00 | >0.05       |
| Hypertension            | 1.30 (1.12-1.50) | 1.22 (1.02-1.44) | 1.35 (1.16-1.57) | 1.33 (1.11-1.58) | 1.00 | <0.01       |
| Anemia                  | 0.82 (0.73-0.92) | 0.96 (0.83-1.10) | 0.95 (0.85-1.08) | 0.82 (0.71-0.94) | 1.00 | <0.05       |
| Liver function          | 1.50 (1.19-1.90) | 1.20 (0.89-1.60) | 1.28 (0.99-1.66) | 0.97 (0.72-1.32) | 1.00 | <0.01       |
| Lipid metabolism        | 1.28 (1.16-1.42) | 1.29 (1.15-1.45) | 1.18 (1.06-1.32) | 1.08 (0.96-1.22) | 1.00 | <0.01       |
| Blood sugar             | 1.29 (1.03-1.61) | 1.63 (1.27-2.09) | 0.99 (0.76-1.28) | 1.14 (0.87-1.48) | 1.00 | <0.01       |
| Glucose in urine        | 1.59 (1.05-2.40) | 1.24 (0.74-2.07) | 1.49 (0.96-2.31) | 2.26 (1.43-3.58) | 1.00 | >0.05       |
| Protein in urine        | 1.22 (0.92-1.63) | 1.22 (0.87-1.72) | 1.12 (0.82-1.52) | 1.64 (1.17-2.31) | 1.00 | >0.05       |
| ECG                     | 1.26 (1.11-1.42) | 1.08 (0.93-1.26) | 1.10 (0.96-1.26) | 1.43 (1.24-1.64) | 1.00 | <0.05       |

## Discussion

In Japan, Industrial Safety and Health Law stipulates that an enterprise with more than 50 employees must appoint an occupational physician in order to provide their employees with occupational health services. However, SSEs are not

legally required to do so. The Japanese government has made efforts to improve the situation at SSEs in recent years. For example, Regional Occupational Health Centers were established for enterprises with less than 50 employees in order to provide these employees with industrial health instruction so as to support industrial health activities.

However, it can hardly be said that the circumstances surrounding SSEs' health status is good.

The results of the present study in a large sample of workers attending health check-ups showed that work intensity, smoking habits, and alcohol consumption were worse in SSEs than in LSEs. In addition, these results suggested that the frequencies of abnormal findings in audiometry (4,000 Hz), hypertension, lipid metabolism, and blood sugar in SSEs were significantly higher than those of males in LSEs. Female workers displayed the same tendency as male workers. These unfavorable conditions in SSEs were consistent with previous reports<sup>1,2)</sup>. In comparing the categories of enterprises, logistic regression analysis and trend tests showed that most abnormal findings in SSEs were a worse status than other categories. Furthermore, these results remained significant after adjusting for age and sex.

In the present study, the criteria for health check-up items were not determined by the Labor Standards Inspection Office, but were established by the employers themselves. In addition, T Association is affiliated with a nationwide organization for health check-up accuracy control, although few health check-up organizations are able to control the results of medical examinations. Therefore, the present study had the advantage in unambiguous criteria, accurate data and standardization of analysis. As the health check-up items used in the present study were the same as those in the report presented to the Labor Standards Inspection Office by employers, the results of the present study can be compared with those in the government reports.

A limitation of the present study was that the number of employees was estimated by the employee who had a health check-up. Therefore, all employees in the enterprise could not be counted. Since an employer must provide employees with a health check-up during working hours, the proportion of workers who take the health check-up can be assumed to be high. Considering this fact, the results of estimation in the present study may not include large errors. In addition,

due to privacy policy we could not determine the work contents of the enterprises. If this had been possible, we could have analyzed the data according to industrial classification.

The proportion of SSEs in the present study was 87.7% and SSEs are likely to account for 97.1% of all Japanese enterprises<sup>3)</sup>. However, the proportion of SSEs workers in this study was 19.8%, which is smaller than the published figure indicating that individuals employed in SSEs account for 62.2% of all Japanese workers<sup>3)</sup>. It is possible that this study could not assess the actual state of SSEs. As the SSEs that provide health check-ups are likely in relatively good situations, determining the actual state of SSEs that do not provide health check-ups may be more difficult.

Therefore, the related government agencies must make further efforts to supervise and motivate employers of SSEs to improve their workplace environments and employees' health status.

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